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Human Behavior Aspects of Staging Areas for Fire Safety in GSA Buildings

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Disclaimer

Many workshop participants alluded to commercial products and systems used in buildings in their submitted papers and during the workshop proceedings. The identification of these products in this report does not constitute an endorsement by the National Institute of Standards and Technology NIST), the Department of Commerce, nor the Department of Transportation.

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HUMAN BEHAVIOR ASPECTS OF STAGING AREAS
FOR FIRE SAFETY IN GSA BUILDINGS

I. BACKGROUND

Over the past twenty-five years, persons previously confined by personal physical limitations to their homes or institutions have joined or returned to the mainstream of life activities. The General Services Administration (GSA) has been a leader by providing accessibility to federal buildings for such persons. Great strides have been made in providing accessible environments that permit persons with disabilities to work for or do business with GSA and the various agencies housed in GSA space.

As the concept of accessibility developed, a concern arose regarding the safety of persons with disabilities who might be in the office building during a fire emergency. It became obvious that attention should be given to assure the safety of building occupants with disabilities if there should be a serious fire.

One approach for assuring the safety of occupants with disabilities, in a fire emergency, is to provide a staging area or an area of temporary refuge where the occupants with disabilities can wait safely until either they can be assisted out of the building or the fire is extinguished. GSA has retrofitted six office buildings with staging areas to upgrade the fire safety for occupants with disabilities. There were no precedents upon which to base the design or the use of the staging areas. This provides a unique opportunity: to evaluate the value of staging areas as an approach for providing a high level of actual safety; to determine the perceived safety of the office buildings by the occupants with disabilities; to find correctable problems; and to develop guidelines for implementing future systems. We are happy to be part of a program that is designed to find these correctable problems.

11. SCOPE OF PROJECT

A full evaluation of the concept of staging areas would include:

1. **A** determination of the effectiveness of the fire protection features of the building in keeping the staging areas free of the products of combustion, i.e., heat and smoke.

2. **A** determination of the human factors considerations involved in making staging areas both useable and safe. Addressed would be such factors as willingness of individuals to use or not use staging areas as appropriate for their physical condition; needed changes or additions to fire emergency plans and training procedures; and needed changes or additions to hardware to make staging areas safe and acceptable.

3. **A** comparison of the relative cost and safety of staging areas with other systems that would increase the safety of building occupants with mobility disabilities. This also might include a comparison of the relative cost and safety of alternative subsystems.

This research project is part of a larger program to evaluate the concept of staging areas. This project is directed at item two above and does not cover items one and three. The analyses are based on the assumptions that the building occupants with mobility disabilities will have sufficient time to reach the staging areas before their routes are blocked by products of combustion, and that the staging areas will remain habitable until the users are rescued. The evaluation of these assumptions is not part of this task but is part of the larger program.

This project includes an evaluation of the ways that building occupants are instructed and trained to use the egress system of the building, with its staging areas, and their response to these instructions and training. The project scope includes all aspects of the staging areas, as installed, that might impinge on their use by building occupants with mobility impairments.

The analyses are designed to highlight problems that might arise if there were to be a major fire. The authors do not mean to imply that major fires are frequent events in office buildings.

This study was conducted on behalf of the General Services Administration (GSA), and all technical work was directed at the use of staging areas in buildings controlled by **GSA. GSA** buildings conduct routine fire drills and have emergency procedures and organizations that would increase the likelihood of the proper use of the staging areas. The results of this study should not be generalized to other buildings that do not have a similar approach.

111. CONCLUSIONS

In general, office buildings provide a relatively high level of safety to occupants of office buildings. Nevertheless, one can easily describe a fire scenario where occupants with mobility disabilities are at a much greater risk than more mobile occupants. Staging areas are spaces in office buildings where occupants with mobility disabilities can find temporary safety until they can be safely evacuated. They are designed to increase the level of safety provided to occupants with disabilities in fire emergencies and, thereby, to decrease their apprehensions.

The General Services Administration has retrofitted six office buildings with staging areas. These buildings vary greatly in size and architectural features.

Since these were the first six buildings so equipped, there were no precedents upon which to base the design or the fire plans. It was anticipated that these first installed staging areas would have items that should be improved or corrected. Therefore, this study was designed to determine items related to the use and acceptance of the staging areas that should be changed and this report includes discussions of such items.

This project is also directed at determining the willingness and ability of the building occupants with mobility limitations to accept the approach and to use the staging areas. This includes

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determining the likelihood that the occupants--including the security staff, the monitors, and the occupants with disabilities--will perform as anticipated.

1. INTENDED USERS WILL ACCEPT THE CONCEPT IF PROPERLY IMPLEMENTED

From the standpoint of the user, in general, the staging area concept is entirely feasible **in principle.** Staging areas can be designed, built and introduced in a way that the intended users will accept the concept, and they will use the areas as intended. From the human behavior standpoint, there may be a potential for increasing fire safety through the use of staging areas.

2. STAGING AREAS REQUIRE SPECIAL MAINTENANCE PROCEDURES

The specially installed hardware features of the staging areas are not part of the normal day to day operation of the building. If any hardware components are in need of repair, it is unlikely that this will be apparent or reported during the normal operation of the building. Special maintenance procedures are needed to assure that all components of the system will perform properly in a fire emergency.

3. STAGING AREAS ADD COMPLEXITY

The use of staging areas adds complexity to the design of the building's fire safety features and to the emergency response procedures. Additional staging areas should be constructed (and current ones should continue to be used) only if procedures and systems are introduced to assure that they are properly designed, constructed and maintained, and only if proper attention is given to the informational needs of the building occupants, including the monitors. It has not yet been demonstrated that this can be consistently achieved.

4. SPECIAL ATTENTION IS NEEDED IN THE DESIGN AND INSTALLATION OF AUTOMATIC FOLDING DOORS

Automatic folding doors as originally installed in staging areas were not properly installed and were not properly designed for use in small staging areas. One of the possible consequences was that the doors could injure users of the staging areas who are slow and frail. All of the problems can be corrected and we have been informed that corrections, including some directly related to safety, have been made in the current installations. The detailed specifications for automatic folding doors in future installations should be made with knowledge of the full range of possible alternative configurations. Both the design and acceptance testing should **be** done with care.

5. MORE HELP AND GUIDANCE SHOULD BE AVAILABLE TO DESIGNATED OFFICIALS

GSA has developed an Occupant Emergency Program Guide to assist Designated Officials in developing emergency plans. While this is a well written and useful guide, its scope is restricted and it does not address many aspects of fire emergency planning. As a result, when Designated Officials use this document as a guide, they tend to give little attention to those aspects of fire safety planning that are beyond the scope of the Occupant Emergency Program Guide. Therefore, the fire emergency plans in the buildings with staging areas were too limited in scope at the times of our visits. For example, little or no information had been given to the building occupants about the fire safety features in the staging areas.

6. COORDINATION WITH OTHER PARTS OF THE FIRE SAFETY SYSTEM NEEDS ATTENTION

The staging areas were designed, installed and made operational without sufficient regard for other aspects of the total fire safety system and building security system. For example, the central points of communications from the staging areas were in guard rooms where a very loud fire alarm sounds during the fire emergency, making the intercom useless; in one such guard room, there was a prohibition against silencing this alarm during the fire emergency.

7. ADDITIONAL ATTENTION NEEDS TO BE GIVEN TO THE PSYCHOLOGICAL AND PHYSICAL NEEDS OF THE USERS

Providing a safe room for people with mobility disabilities is not sufficient. The room should provide for a minimal level of physical and psychological comfort. Examples where insufficient attention was given to this include: the small staging areas did not have seats or benches to provide some physical comfort; there were no vision panels in the door to provide psychological comfort; the systems were not explained to the potential users; and no one checked to see if the automatic folding doors were operating safely, i.e., if they stopped for an obstruction.

8. COORDINATION WITH FIRE DEPARTMENTS IS IMPORTANT

There is the implicit assumption that the fire department will rescue building occupants from the staging areas, but there was little contact between the fire department and the people designing, installing and using the staging areas, and what little contact we found appeared to be with the fire prevention side of the fire department. This has a variety of consequences. We are unaware of any pre-fire planning conducted by local fire departments regarding how they would modify their response to a fire in response to the installation of the staging areas. We noted that, in one building, there was a sign

in the staging areas instructing the users to report their locations by dialing 911; the fire department had been unaware of this and, therefore, prior to our visit, had not instructed those answering "911" about the existence of the staging areas. In another building, we were informed that efforts were made to involve the fire department but the overtures were rebuffed.

9. MANY USERS HAVE "HIDDEN DISABILITIES"

A majority of the users of staging areas that we observed did not use any mechanical device--such as wheelchairs and crutches--to assist them in their horizontal movements. They had problems with their backs and knees that made ascending and descending stairs slow, difficult or painful. Others risked aggravating existing injuries. They did not appear to be particularly sensitive to being identified as needing special consideration. There does not appear to be any problem in having such employees identify themselves.

10 MORE ATTENTION NEEDS TO BE GIVEN TO FIRE **SAFETY** DURING CONSTRUCTION

Fire safety efforts tended to be directed toward providing safety during the normal operation of the building. Danger is greatest during periods of construction. We visited some buildings after the staging areas were largely constructed and before the staging areas were included in the fire safety plan. During this time employees might use the areas but the designed safety may not be provided; e.g., no one may be assigned to receive information from the users through the specially installed intercom system. Attention needs to be given to special fire safety hazards during period of construction.

11. MORE INFORMATION SHOULD BE GIVEN TO BUILDING OCCUPANTS

There appeared to be very little information transmitted from those that have it to those that might need or want it. For example, in one building, the staging areas were not included in the then current fire safety plan because the responsible official had not received technical information that would have assured him that the areas were safe. He also needed this information when developing a fire safety plan. We visited all six buildings and interviewed many employees with disabilities and many monitors; they were generally uninformed about the specific hardware features of the staging areas and additional information would have given them more confidence in the safety of the areas, such as, there is a dedicated source of fresh air and that source should slowly push out any smoke that gets into a staging area.

12. **SIGNAGE** WAS MINIMAL,

There were signs identifying the staging areas and a few signs inside the staging areas relating to use of the telephones. Several officials indicated that they believed more signs would be useful, but it appeared that the designated official expected the landlord to provide the additional signs and the landlord expected the tenants (i.e., the designated offical) to provide any needed additional signs.

13. DOORS IN FIRE BARRIERS WERE OPEN

Large staging areas were constructed by upgrading existing walls and doors, i.e. installing horizontal separations. Prior to this upgrading, some of these doors were routinely left open. *As* part of the upgrading, door closers were installed on these doors, but we found many that were propped open with wedges, boxes, etc. While many of these doors were closed during fire drills, it is still a serious potential fire safety problem.

14. ASSEMBLY AREAS NEED COMMUNICATIONS SYSTEM

When large staging areas are provided, the safe side of the horizontal separation is not clear until information is provided to those seeking shelter regarding the location of the fire. The occupants with mobility problems go to an assembly area to get this information. A special communications system or procedures for using an existing communications system, e.g., the telephone system, would facilitate this communication. The areas of assembly should be in areas serviced by the selected communications system.

15. STAGING AREAS ARE USEFUL FOR VISITORS

Staging areas appear to be especially valuable in providing safety to visitors of agencies serving citizens who have health concerns or disabilities.

IV. ORGANIZATION OF THIS REPORT.

This project was undertaken with two major goals:

To provide technical information that could be used by the sponsors in evaluating the advantages and limitations of the use of staging areas to provide safety for occupants with disabilities in office buildings.

To provide guidelines that could be used in implementing additional staging areas in the future.

The first goal is to meet the needs of decision makers; the second goal is to meet the needs of those who might design and implement future systems. The remainder of the main body of this report is primarily directed at the needs of decision makers. The appendix is primarily directed at anyone who is responsible for developing the emergency plan and training occupant emergency organization members in the use of staging areas. Although much of the technical information developed by this project will be reported in both the main report and the appendix, those who will design the hardware systems should find both sections of value.

V. THE VALUE OF STAGING **AREAS**

A. TECHNICAL APPROACH

The concept of the staging areas has obvious appeal. The question is: will staging areas work in a way that they add significantly to the safety of the building occupants with limited mobility without decreasing the general safety? The best way to answer this question is to compile all the available information pertinent to how staging areas are likely to operate in a real fire emergency. The analysis of the information is conducted by identifying obstacles to the successful systems performance of staging areas, and then making judgments about how and whether those obstacles can be overcome.

Sources of information available to the researchers included: (1) written fire emergency plans; (2) comprehensive interviews with GSA building officials, officials of the tenant agencies, emergency team participants, and building occupants at large, especially those with disabilities; and, **(3)** on-site inspections of the facilities, including observations of fire drills conducted in five buildings and the operation of hardware during testing.

The validity of our conclusions is limited by the following factors: (1) the types of buildings in which staging areas have been installed are quite diverse but are still limited in range; and, (2) the on-site visits were mostly conducted before designated officials had finalized and implemented procedures for the use of staging areas. Some shortcomings were likely to have been resolved before our visits if the visits had come at a later date.

B. TALL BUILDINGS

None of the buildings we studied were truly tall buildings, buildings where evacuation by stairs for a normal healthy adult would be considered an onerous task. Such buildings are likely to have zoned evacuations and evacuations to other floors in the building. Extrapolations of our results to such buildings should be made with care.

C. OCCUPANTS WITH MARGINAL MOBILITY PROBLEMS

There appeared to be a tendency for the building management to classify building occupants as having a disability if they are unable to descend or ascend stairs at a normal rapid pace,

that is, if they cannot negotiate the stairs or if they would impede the flow of other occupants on the stairs. In addition, occupants might self-classify themselves as having a relevant disability if using the stairs would impose a health problem. Some of these occupants can and would self evacuate in a dire emergency--if fire conditions permit--but prefer to use the staging areas in fire drills.

It is important that any actions practiced in a fire drill be appropriate and safe behavior in a fire emergency. Some occupants with mobility problems will use staging areas in fire drills but do not plan to use them in fire emergencies. The use of the stairs may cause pain or injury to these occupants and the avoidance of this pain or injury should be credited to the value of staging areas in evaluating costs and benefits. We would not recommend that this option be encouraged; nevertheless, one can assume that this option will be used by some occupants.

It is important to note that these occupants do not plan to use the staging areas in real fires. However, when the alarm sounds, they normally will not know if it is a real fire or a drill and will assume it is a drill. If they later choose to evacuate, the delayed evacuation, coupled with their generally slower travel speeds, might significantly increase their risk. Despite this additional risk, the staging areas should increase safety for the occupants with marginal mobility problems if information is provided that warns them away from hazardous actions.

A sensitive area is the actions recommended to those who can physically use stairs to evacuate but whose slow movement would impede the movement of others on the stairs. We interviewed building occupants who were willing to rely on the staging areas rather than impede the evacuation of their co-workers. (We also anticipate that some citizens with such disabilities would strongly object.) Although our sample was too small to make any definitive statement, we did notice a greater willingness for employees with marginal mobility problems to use the staging areas in the buildings that had a well organized set of building fire marshals. As one **GSA** employee stated, "You have to earn their trust."

D. VISITORS

Government office buildings outside the Washington, DC area often contain field offices serving the public. The visitors we observed included citizens who were elderly and citizens with mobility problems. For example, there was a Social Security appeals hearing room on the sixth floor of the Toledo Building. At the time of the fire drill there were at least two visitors in the hearing room who classified themselves as having a disability.

These two visitors and other visitors in the hearing room were sent to the staging area during the fire drill. We did not investigate to determine who sent them to the staging area or why he or she sent the visitors with no disabilities to the staging area; we felt that trying to determine the identity of the person would be interpreted as a criticism of the action. (We believe that the action was reasonable.) We assume that he or she felt it would be easier, quicker, and safer to send all visitors in the hearing room to the staging area than to try to determine carefully who can rapidly and safely descend six flights of stairs and who cannot. (The staging area was an elevator lobby with sufficient capacity.)

Staging areas appear to be especially valuable in providing safety to visitors of agencies serving citizens who have health concerns or disabilities.

E. ACCEPTANCE OF STAGING AREAS BY OCCUPANTS

We found an encouragingly positive reaction to the installed staging areas by occupants with mobility problems. At the beginning of the interviews, the workers with disabilities were relatively uninformed about the staging areas. The positive responses were given after the system was explained. We could not determine the relative contributions of the following factors:

> The perceived protection provided;

> The enthusiasm of the interviewers;

> The special personal attention they were receiving by virtue of being interviewed;

> The interviewees with disabilities could not think of a better solution to the problem; and

> At last somebody was doing something.

VI. LARGE STAGING AREAS

A. TYPES OF STAGING AREAS

The staging areas were basically of two types: 1. a major portion of the floor area, (e.g. one half or one third of a floor); or **2.** a small area of a floor (e.g. a single room). We will use the label "large staging area" for an area that encompasses a large portion of a floor of a large building, protected from fires on the remainder of the floor by horizontal separations. We will call a staging area that encompasses a room sized space, a Small Staging Area. The main thrust of later sections of this report is the small staging areas. This section addresses the large staging areas.

B. FIRE BARRIERS

Large staging areas are separated from the fire by a fire barrier composed of substantial walls and doors, which should keep the combustion products outside the staging area long enough to give the fire department time to either extinguish the fire or evacuate the staging area. Retrofitting a building with large staging areas usually means upgrading existing walls and doors and putting self-closing or automatic closing devices on each door in the fire barrier. The doors should self close automatically after every opening or should automatically close

when the fire alarm sounds. If the door is open during the fire, fire and smoke can easily extend into the staging area.

In the Cohen Building we found paper wedged under the recently installed automatic closing fire door in the fire barrier across the main hallway. While the door normally would be in the open position without the wedge, it apparently closes occasionally when there is a fleeting interruption (or maybe spike) in the electric current. This is an example of the need for continued attention to the status of fire protection features in buildings; the importance of this need increases with the use of staging areas.

We found office suites that had offices on both sides of the fire barrier. Doors in the fire barrier that had self-closers, to keep the doors closed, were kept open with wedges, boxes and other items. During visits to the two buildings with large staging areas, we discussed this with some building occupants and they stated that they were already informed that the wedges, boxes, etc. should be removed if there is a fire or a fire drill. We checked on two such doors in the Cohen Building and they were removed during the spring fire drill. Nevertheless, this is not a safe procedure. The self-closing devices should be replaced with automatic closers that will close the doors when the alarm sounds or the power in the building is lost. This will still require a never ending program to keep the path of the doors free of obstructions, the automatic closers in excellent condition, and wedges not placed under the doors.

If a new building were constructed with large staging areas, we can assume that there would be fewer doors in the fire barrier than in a retrofitted building, perhaps only one on each floor in the main corridor. This, of course, would decrease the problem.

C. EVACUATION

Large staging areas will have stairs that will permit the easy exiting of all able occupants, including those who can only descend stairs very slowly. These stairs can also be used by the fire department. There is also a good chance that there will be elevators in the staging area that can be used to evacuate occupants with mobility problems--the VA building had elevators on both sides of the fire barrier, (but near the fire barrier on only one side).

D. COMMUNICATIONS

Small staging areas have dedicated communication systems to keep the occupants aware of the status of their rescue and to provide information to the fire department. (See Section--VIII-B. COMMUNICATION SYSTEMS.) We did not observe any dedicated communication system in the large staging areas. It is likely that the existing telephone system can serve satisfactorily to transmit the information. However, there are no telephones or intercoms by the hallway doors in the fire barrier, which may make communications cumbersome. Furthermore, it is important to develop procedures so that information can be transmitted efficiently at a time when the communications capabilities, especially those of the fire department and other groups involved in the rescue, will tend to be overloaded.

If a floor has a large staging area, it will have at least two. It is possible that there will be a dangerous fire in one of these areas. Obviously, the people with disabilities should use the one that does not contain a dangerous fire. However, most building occupants will not know, at first, the location of the fire and will not know which staging areas to use. Procedures must be developed to provide the occupants with disabilities with the necessary information. While waiting for the information, they should relocate to an area near the horizontal separation separating two large staging areas.

VII. THE DESIGNATED OFFICIAL, AND HIS RESPONSIBILITIES

A. ROLE OF THE DESIGNATED OFFICIAL

The Federal Property Management Regulations "places responsibility for managing emergencies in a Federally owned or leased facility upon a 'Designated Official,' who is '...the highest ranking official of the primary occupant agency or .. a designee selected by mutual agreement of occupant agency officials'." (Reference: Occupant Emergency Program Guide, U.S. General Services Administration, U.S. Government Printing Office: 1990, p.3.) **As** part of this responsibility, the Designated Official is responsible for developing the occupant emergency plan, and selecting and training occupant emergency organization members.

The staging areas as designed and installed by or for GSA in the six buildings were not complete installations: the fire plan and some posting of signs was left to the tenants. In addition to his or her normal responsibilities listed above, the Designated Official is responsible for informing or training the building occupants, including occupants with disabilities.

The development and implementation of the occupant emergency plan depends on the Designated Official, and the proper use of staging areas depends on the proper design and implementation of the occupant emergency plan. We are unaware of any safeguards for situations where the Designated Official is not successful in implementing a proper emergency plan. A good occupant emergency plan is very important for the proper use of staging areas. Occupants with mobility disabilities cannot self evacuate from upper floors and depend on the occupant emergency plan more than other building occupants.

B. NEED FOR ASSISTANCE

The Designated Official is normally the highest ranking official of the primary occupant agency. As such, responsibility as the Designated Official is a minor part of his or her total workload. In a large single agency building, the designated official may be able to delegate most of the work to a full time, knowledgeable safety officer. In a smaller building, housing a number of tenant agencies, each with a small field office, it is likely that neither the Designated Official nor anyone assisting him or her has had much training, experience, or knowledge in the area of fire safety, nor much time allocated to address fire safety problems.

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We found that little information was given to the Designated Official. In most cases, a copy of the Occupant Emergency Program Guide was the major assistance given to the Designated Official in performing these tasks. We are unaware of any efforts to instruct or inform the building manager or the Designated Official about the details of the hardware features of the new fire safety system or how to incorporate these new systems into a fire safety plan. The Designated Official was given no guidance, assistance or training aids in developing training programs. While there is merit in assigning responsibilities to local officials, these local officials should be given technical support and information, guidance, and encouragement.

To varying degrees, all the emergency coordinators felt a need for some type of guidance or additional information. While this need was acute in reference to staging areas, it also was felt necessary for emergency planning in general. Some emergency coordinators expressed appreciation for the general guidance provided by the "Occupant Emergency Program Guide," but many also expressed the need to discuss issues and receive building-specific guidance from a qualified professional.

If staging areas are installed in additional buildings, attention should be given to providing more information and assistance to the Designated Official. (It would still be useful to give some of the items below to the Designated Officials in the six buildings currently with staging areas.)

> Information about the details of the installation should be given in a timely fashion. To fulfill his or her important function the Designated Official must be informed about the characteristics of the staging areas and how they function. We found one building where inclusion of the staging areas in the Occupant Emergency Plan was waiting for the responsible official to be satisfied that the staging areas were properly designed and constructed. Although the hardware appeared to be functioning, he was waiting for answers to specific questions.

> Signs should be included as part of the installation provided by **GSA** or, at least, guidelines for installing signs should be provided. If **GSA** provides the signs, the Designated Official should have the authority to add or modify signs; it takes less experience and knowledge to improve a set of signs than to design the initial installation.

> Training aids would be helpful. Some viewgraphs and diagrams should apply, unchanged, in a good percentage of buildings with staging areas.

> Advice for developing fire safety plans and procedures written for the building occupants should be provided. The guidelines in the Appendix of this report are designed to provide some of the needed assistance.

C. WRITTEN FIRE SAFETY PLANS

1. Occupant Emergency Program Guide. Many of the officials that we interviewed at the six buildings had a copy of the document "Occupant Emergency Program Guide" distributed by the **GSA** Public Building Service, Federal Protective Service. This Guide is well written and contains much useful information. Some of the Occupant Emergency Plans were based on the guidance given in this publication.

2. Purpose of the Occupant Emergency Plans. The plans were good from the standpoint of establishing an organizational structure for emergency situations. However, the Occupant Emergency Plans, that we reviewed, were not designed to provide useful information to the building occupants. We had the impression that the plans were written to meet the needs of management rather than the informational needs of the building occupants. Since most of the plans predated the installation of the staging areas, they did not contain information about the staging areas.

We believe that a document should be distributed to each employee that describes the fire emergency plan in simple language. It should contain a simple explanation of the features of the staging areas, how they are designed to be used, and guidance as to who should use them. It appears reasonable that the Occupant Emergency Plan be expanded to include this information but a separate document might be preferable. The appendix of this report discusses, in more detail, the information needs of the occupants.

3. Selecting and Training Monitors. The Occupant Emergency Program Guide, which is widely used in developing written fire safety plans, emphasizes the need for an organized command structure. This includes a network of wardens or monitors who are employees assigned responsibilities in emergency situations. The Occupant Emergency Program Guide lists "floor monitors", "area monitors", "elevator monitors", "stairway monitors", and "monitors for the handicapped" who assist those people with disabilities needing assistance. (Sometimes they are called wardens.) In many cases, it appeared that management expected monitors to assume their responsibilities during drills or actual incidents without having received any prior training. Management should not expect them to perform their duties in a proper manner without assistance, including a clear explanation of their duties. This assistance would normally be some combination of hands-on training, written documents, and group discussion sessions, including feedback sessions immediately after drills. However, management should also minimize the burden on monitors by using appropriate materials and by training only to the degree needed for them to reliably perform their duties.

In several buildings **we** found that the assignments were not kept up to date. The employees identified as having a disability and needing assistance did not know who, if anyone, was currently assigned to assist them. The staging areas will not provide the designed level of safety unless the assignment and training of monitors is kept up to date. Furthermore, if these assignments are not current, employees with disabilities will have less confidence in the total fire safety system and in the safety of the staging areas.

The duties and responsibilities of being a monitor are a minor aspect of the monitor's job. The duties require a very small proportion of the employee's time on the job, including training activities, and discussion sessions, if any. The quality of performance normally has no effect on his or her performance evaluation. On the other hand, the assignment does involve the safety and psychological comfort of fellow workers, especially those with mobility disabilities. In our interviews with monitors, we found some who took the assignment seriously and others who did not. This attitude seemed to depend on cues they received from management. Monitors are more likely to take the responsibility more seriously if the list of monitors is kept up to date and the monitors receive training, information or other assistance related to their duties.

We have emphasized above the need to keep the assignments of monitors up to date as the assignments change due to the monitors moving to new locations, resigning, retiring, etc. We observed two very different approaches. In one building, the lists are stored in a computer in a word processing format. Lists are distributed for corrections and updating. Making changes is relatively easy and is done frequently.

In the Toledo Building, the Designated Official was attempting to make assignments to the Occupant Emergency Organization by position or assignment. When a monitor was reassigned, or otherwise left a position, his or her replacement would automatically be given the responsibility. This, also, would help solve the common problem of assigning an alternate to each monitor where the alternate might not know if the primary monitor is able to respond, so both would usually respond. The alternate would be the employee who fills in for the monitor on all other aspects of his or her job. This appears to have some promise for assignments to the Command Center Team and Floor Monitors where the assignments can be given to senior officials with formal deputies or alternates; it appears to have less potential for the positions that are normally filled by workers without administrative responsibilities and without automatic alternates. While it is not clear that this approach is workable, it has some desirable aspects. It is worth following this attempt.

4. <u>Informing or Training Occupants</u>. One might think of the building occupants who use the staging areas as passive recipients of the safety provided. The only actions required of the occupants with disabilities, or the monitors assigned to assist them, are: travelling to the staging area; and entering the staging area which usually involves opening a door. However, they are active participants in their own safety when they use the communications system, phone or intercom. Furthermore, they must decide to use the staging area, to go to the staging area, and to stay in the staging area. Their willingness to use the staging area will depend on their degree of confidence in the safety provided. Many employees will get this confidence only by being informed about the safety features of the staging areas.

Each Designated Official will need to develop a procedure for informing and training employees and visitors about the staging areas and its safety features. The procedure should be tailored to the characteristics of the building and its occupants. The guidelines in the appendix of this report should assist in developing **the** local training programs.

When an upper floor (or basement floor) of a building is used as a museum or for other public use, special attention should be given the information needs of the visitors. We did observe a fire drill in the Pension Building which contains a museum on its first two floors. However, there were no known unescorted visitors with mobility problems in the museum area at the time of the drill.

5. Description of Staging Areas in Written Fire Safety Plans. A major concern of ours is that the Fire Safety Plans are written as administrative documents and not as informational documents for the general employee or the employee with disabilities. For example the following paragraph is quoted from the section of a proposed Occupant Emergency Plan devoted to the duties of the Floor Warden and those who report to him. While it does have the potential of conveying information to a literate employee with physical disabilities, it is obvious from the location of the material and the language used that the intended audience is not the average employee with a mobility disability.

> "Handicapped Monitor/Handicapped Employee. Each employee designated as having a handicap preventing them from evacuating the building without assistance will be assigned an assistant from that Division who will remain with them throughout an emergency situation. These individuals will go to the nearest stairway with a handicap monitor, and if in a safe area will remain outside the stairway. If in a danger area, they will be moved by the handicap Monitor to the next stairway or to that floors' fire evacuation staging area. They will be held in this staging area until it is determined that evacuation is absolutely required. These staging areas located at each end wing on floors two through five and in the basement adjacent to the G-700 corridor past the south tunnel, were constructed specifically for this purpose, and are fire-rated throughout, including the doors entering into the area. If evacuation is not possible, these unique holding areas may be used until fire/rescue personnel respond to assist in safe passage from the building. These newly constructed staging areas are in operation 24 hours a day for the handicapped, and are wired to the building's zone alarm system. Handicapped employees needing special assistance should still maintain volunteer handicap monitors during nighttime/weekend hours. Visitors and tourists should also be made aware of the staging areas and locations."

The following paragraph was found in the BUILDING INFORMATION SHEET of the same draft Occupant Emergency Plan. Its language is better but its location makes it clear that the intended audience is not the potential user of the staging areas.

> "On floors two through five, the end wings have been reconstructed to become fire evacuation staging areas. These areas, built primarily for the handicapped, have been constructed with fire rated drywall and doors, which are electronically controlled through the building zone fire alarm system. Employees may be staged in these areas until evacuation is possible, or await fire and rescue personnel. A smaller staging area has been constructed on the ground level outside the G-700 corridor, just beyond the south tunnel corridor. As in the end wing locations, this staging area is built with fire rated materials, and has a special intercom for communications with the command center personnel, as well as a separate ventilation system and emergency lighting."

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In quoting these two paragraphs, the intention is not to criticize any one plan but to illustrate the common practice of preparing only administratively oriented documents and neglecting the informational needs of the potential users of the staging areas.

VIII. HUMAN FACTORS CONSIDERATIONS RELATED TO PHYSICAL FEATURES

A. AUTOMATIC FOLDING DOORS

The small staging areas in five of the six buildings used a special sliding, folding, curtain door to separate the staging areas from the corridors. This special door meets the requirements of a Horizontal Sliding Door in Section **5.2.1.14** of the Life Safety Code. It is commonly called an automatic folding door. It is our understanding that most installations of automatic folding doors are for somewhat different purposes than its use as a door for small staging areas. It is usually used to protect large openings; often it is used more like a "moveable" fire wall than a fire door. The automatic folding doors selected appear to have been originally designed with considerable flexibility. However, the doors as originally installed contained options for large openings that make the installations unsatisfactory and not as safe as they could be; this is the source of some of the problems. However, it appears that all the problems we uncovered could be avoided in future installations relatively easily.

> Since we believed that the original installations posed an unexpected hazard, we informed an official of the manufacturer of our findings. We have been informed by him that changes are being made to upgrade the safety and operation of the installed doors. Both the promised date of this report and the project budget do not permit revisiting all the installations and evaluating the changes after we hear that the changes have been made. We do plan to revisit the Pension Building and will report on our findings in the final quarterly progress report. The following paragraphs in this section were written prior to our discussing the problem with the manufacturer.

It is possible to make some of the needed changes by simple changes in the settings of the controls. For example, we were told that the disturbing alarm described below can be turned off by such a change in the controls. However, we did not find any representative of either the GSA building manager or the Designated Official who had been informed of this feature or who had the equipment to change the controls. It is obvious that either the local officials be given the necessary information and tools, or more attention be given to the design, installation and acceptance of the doors, or both.

The defects, limitations, and other problems we noticed are:

1. Viewing Panels. The automatic folding doors, as installed, do not have a viewing panel as do some alternative fire rated doors. (It is our understanding that the selected door can be installed with a small viewing panel for an additional charge of about $200 per door. We assume that doors to small staging areas could have two viewing panels or a viewing panel with two viewing areas: one for those in wheelchairs and one for those standing.) The ability to

visually see what is occurring immediately outside the staging area might decrease the anxiety of those occupants awaiting rescue from the staging area. Despite all the precautions to prevent it, smoke might get into the staging area. Without a vision panel the occupants would have no visual information regarding the safety of opening the door to determine if they can safely leave the staging area. We have not seen the available viewing panels so we cannot comment on whether the available panels are satisfactory. This is an area that needs more study.

2. Response to Obstruction. The automatic folding door has a safety feature to stop the closing of the door when it encounters an obstruction such as a slow moving person. The owner's manual states, "If the door encounters an obstruction, the door will retract 6 inches, delay, then attempt to close again." We found that this feature did not work as stated. It appears that the door was designed for this feature to operate only after the door has moved a prescribed distance. The reason for this is that the doors are usually designed to seal a large opening and the door is hidden behind a visual shield or long and thin pocket cover door. The automatic folding door is designed to push aside the visual shield or long and thin door. *Also,* even some of those doors that did move the prescribed distance before meeting an obstacle did not retract or required too much pressure to stop. The automatic folding doors, as we observed them, are hazardous, and could seriously hurt a very slow moving person. If this has not already been corrected in the current installations, it should be corrected as soon as possible. Care must be taken in any future installations to assure that the door always retracts as soon as it meets an obstruction.

3. Bi-parting Doors. Some of the wider doorways in the staging areas have bi-parting or double doors, i.e., there are two doors that close at the same time and meet in the middle of the doorway. Only one of the two doors contained the feature that would stop the doors: the closing doors could seriously injure a slow moving person. If this has not already been corrected in the current installations, it should be corrected as soon as possible. Care should be taken in any future installations to assure that each bi-parting door retracts as soon as it meets an obstruction.

4. Disturbing Alarm. When the building alarm is activated in the Whipple Building, the door automatically closes and a high pitched supervisory alarm sounds as part of the door system. We are unaware of any practical use for this alarm in a staging area during a fire emergency: after a fire or fire drill it might assist the building staff in locating automatic folding doors that need to be manually reset. Within the Whipple Building the alarm was so loud during a fire drill that none of the occupants with mobility problems, who came to the staging area being observed, remained in the staging area; they waited outside the area in the hallway. If they had remained, they would have been unable to use the telephone and would have had difficulty communicating. It is our understanding that the alarm was included in the design of the door at the request of regulatory authorities; however, it is our understanding that these regulatory officials were not evaluating the doors for use in small staging areas. This alarm should be deactivated (or made much less intrusive). It is very important that the alarm be deactivated properly because the alarm system is used for other purposes such as to indicate a low battery in the backup electric supply. Care should be taken in any future installations to assure that the alarm does not sound loudly in or near the staging area.

There was some fear that the alarm would cause permanent hearing loss: the fire department measured the loudness in <u>one</u> staging area and it was 88 dB. While prolonged exposure to loud sounds can lead to a hearing loss, 88 dB is below the level usually associated with hearing loss from occasional exposure.

5. <u>Test Doors in Alarm Mode</u>. We had limited opportunity to test the doors in the alarm mode: the only way we knew to put the door into the alarm mode was to activate the building alarm and run a fire drill (or announce that the alarms were being tested). There should be a simple way to put the door into the fire alarm mode for testing the operation of the doors and for training building occupants with a disability.

6. <u>Potential Loss of Electric Power</u>. We were told that the doors had battery backups. The owners manual states that there is a coded alarm to alert the building staff of a low battery voltage and of either a high or low **AC** line voltage. *An* even lower battery voltage will cause the door to automatically close to assure a closed door in case of fire. (The closed door will also encourage the building maintenance staff to give attention to the problem.)

An important question is: if all power is lost, including any battery backup, can a closed door be reopened and can an open door be closed? It is important that the occupants of the staging area and fire fighters have the capability of opening and closing the door at all times and under a variety of fire conditions without the use of tools. It is our understanding that closed doors can be opened and closed manually if all power fails. (Some of the doors are designed to lock closed when the temperature outside the staging area becomes lethal.) However, the physical effort required would be beyond the capabilities of most employees who would use the staging areas and possibly beyond the capabilities of some of the monitors assigned to accompany the disabled users of the staging areas. Given the low probability that the power would fail, and the fact that the fire fighters can open the doors in an emergency without tools, this should not be a significant problem.

7. <u>Uniqueness of automatic folding doors</u>. The automatic folding door, as used in the small staging areas studied, is a fire door with a 1 1/2 hour rating designation. In every application it would have been possible to have installed a more traditional fire door with the same rating, presumably at a lower cost. The automatic folding door does have some advantages, as well as some disadvantages, from a human factors standpoint. While we will address these advantages and disadvantages, we will not attempt a full competitive cost benefit analysis.

A major advantage of the automatic folding door is that it moves perpendicular to the direction of travel of the users, i.e. it does not swing. This has several desirable consequences:

> Users can be quite close to the door without any problems.

> The panel for opening the door can be on the door. This makes it easier to find and permits the user to be ready to enter or leave the area as soon as the door opens. Hence the door-is open for a shorter period of time.

The door is easy to open by a person with little strength which is common among persons likely to be using staging areas.

The door can be fitted with an effective mechanism for stopping quickly whenever encountering an obstacle and still, under normal circumstances, close rather rapidly.

The viewing panel in a standard door can be presumed to be very superior to the panel available for an automatic folding door. We have not personally looked through the viewing panel for a automatic folding door but it appears to be too narrow to be easy to use or to provide a good view.

An important disadvantage of automatic folding doors is that, while conventional doors can be opened manually just slightly to check conditions, and can be closed quickly to limit smoke entry, it appears that the commercially available automatic folding doors cannot.

There were applications where automatic folding doors had a special aesthetic advantage over a more traditional fire door. The Pension Building is an historic building and there is a strong desire to maintain as much of the original architecture as possible. On the second floor, the entrances to the two staging areas are tall. To install traditional fire doors, the entranceway would have been "framed-in" to permit installation of the doors, and the ceremonial nature of the entranceway would have been lost. There also may have been less visual impact on the openings into the elevator lobbies/staging areas in the Toledo Building.

B. COMMUNICATIONS **SYSTEMS**

1. <u>Need for Proper Design and Installation</u>. *An* important feature of each small staging area is a communication system that uses a telephone, intercom, or other means for the occupants of the staging area to communicate with the outside. This communication system is used to alert the fire department of their situation and to learn about the progress of efforts to rescue them. All small staging areas had either a telephone or intercom to perform this function. If the system designer fails to carefully consider how the system interfaces with the users in the staging areas and with the officials receiving the information from the staging areas, a communication system may operate as specified but be of limited use, or even of no use.

We noticed a number of design deficiencies and operational problems that decreased or negated the usefulness of the installed communication systems. The number of problems we found with these communication systems indicates that this could be a major problem area. However, with sufficient emphasis on the need for proper design and sufficient supervision of the design and installation process, there is no reason for a repeat of the deficiencies.

A properly operating communications system is not necessary to provide physical safety to those seeking refuge in the small staging areas. This is good because both telephone and intercom lines can be disrupted by the fire. Firefighters should include all accessible staging areas in their search and rescue activities. The Bemidji Fire Chief implied that information about the presence of occupants in the staging areas would not affect their search and rescue

operation: they would cover the whole building. Nevertheless, the communication system can greatly add to the psychological comfort of those in the staging areas and the information given the fire department, obtained from the occupants of the staging areas, could affect the priorities of actions by the fire department. In a large building with rapid fire growth, a speedy, thorough search is unlikely, and assigning priorities based on information could be important.

Examples of problems we observed with the communications systems in the small staging areas are presented in the next two sections.

2. <u>Problems with Telephone Systems</u>. In the Bemidji Building the telephones were placed in a receptacle with a transparent plastic cover. The receptacle was designed for a different purpose. Considerable manual dexterity is required to take the phone out of its receptacle. Many citizens with disabilities would not have the manual dexterity necessary to take it out. Even more dexterity is required to replace it properly. There is a good chance it will not be replaced properly if anyone ever uses or tests it, causing the phone to be dead when someone tries to use it. (It was not replaced properly by one of the authors once when we were testing it.)

We were informed that all the phones in the staging areas of the Bemidji Building were on a single phone line. Potential users of the phones were not informed of this through either training or signs. This could cause confusion in an emergency. Furthermore, if one phone were replaced incorrectly, as described above, all phones would be dead.

There was an alarm attached to the cover of the receptacle to discourage casual use or pilferage of the phone when there is no emergency. The alarm was designed to stop automatically after a period of time that seemed like a very long time but was probably about 10 seconds. In an emergency, the user is likely to quickly replace the cover to shut off the alarm: the potential user might never use the phone, if he or she has not been instructed or trained.

A sign in the small staging areas in the Bemidji Building instructed those seeking shelter in the staging areas to call 911. The operators or dispatchers answering 911 are employees of the Police Department and had not been informed about the staging areas. (We assume that since our visit they have been informed.) Therefore, the caller would have had to explain his/her problem to the operator at a time when the operator would be very busy with other crucial duties and responsibilities. Furthermore, it is our understanding that the office receiving 911 calls had no <u>direct</u> means for communicating with the fire fighters at the fire. Given the number of links needed to transfer messages, we are concerned about the reliability of communications between staging areas and the fire department command center at the fire. The presumed failure to consult with the fire department at two crucial times--i.e. prior to finalizing the design of the system, and after installing the system--is an omission that should not be repeated if additional staging areas are installed with this type of phone system.

In the Toledo Building, the phones in the staging areas automatically call a guard office in Detroit that **is** manned at all hours. Directing the calls to an office that is always manned is

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important. The automatic dialing system did not work on several of the phones in small staging areas, i.e. elevator lobbies, when we checked them the day before the fire drill. The problem was easily corrected and at least one phone was used and worked properly during the fire drill. We were told that they had recently been checked and corrected. The automatic dialing equipment installed does not appear to be sufficiently reliable. *Also,* persons in staging areas cannot talk directly to fire fighters at the scene, but must relay messages via the Detroit Federal Protective Service Office.

The phones in the Whipple Building were connected directly with the security office of the building. There is no need to dial, the dialing is automatic when the "phone" is taken off the hook. However, the phone has a non functioning push button dial pad: apparently it was deemed cheaper to use a mass production normal phone than a simpler but less common phone without the dial pad. Having a phone with a useable dial pad is confusing. There were no signs near the phone to alert the occupants about how the phone operated. Similarly, no training had been given or other information disseminated. Such phones are also a more likely object for pilferage than a phone with no dial pad.

When using phones, the office answering the call receives the call on a regular non-emergency phone line. It is necessary for the caller to identify his location and the problem. This illustrates the need for training and signs.

3. Intercom. The intercom systems, which are in the three Washington buildings, were similar and were easy to use. The operation of the intercom in the small staging areas is simple and obvious. The operation of the master units is more complicated but easy to learn: however, we did not find anyone who had received any training and the system of staging areas was not yet included in the fire plan. We have serious concerns about how well they would work in a real fire if no improvements are made. Instructional signs are needed and both the security staff and the disabled employees should be properly instructed.

The master control should be placed in a location where a trained, responsible person can communicate with the users of the staging areas, and with the fire department and others involved with the safety of the occupants of the building. We found cases where these simple and obvious requirements were not met.

In the **VA** building and in the Cohen building, the master control for the intercom was in a room where a loud alarm sounds during the fire emergency. This makes the intercom systems essentially useless.

In the Cohen building, the master control for the intercom is in the alarm room where no one is normally stationed and where there is no easy means of communicating with the security staff or the fire department. No one was stationed there during the fire drill. While this could be corrected, dedicating a person to this function is not an efficient use of emergency personnel. More important, dedicating a person to this function may not be a sufficiently reliable way of providing the service; it is too easy for the assignment of this task to "fall between the cracks" or for the person to be reassigned during the fire to other tasks at a different location. That, also, would make the intercom system essentially useless.

In the Pension building, the master control for the intercom is in the atrium near the main entrance, an area where the person manning the control has no easy means of communicating with other members of the security staff or with the fire department. While this panel was manned during the fire drill, it does require a person dedicated to this function, which, as described above, is not a reliable procedure. On the other hand, the building does not have a security office or a twenty four hour security staff. There is a guard desk that is manned when the museum is closed but it is a short walk from the master control for the staging area. We have no simple remedies that involve continuing to use an intercom system. **A** telephone system, with automatic dialing, that directs calls to a properly manned central location, might be better.

All of the intercom stations employed speakers rather than earphones. In a noisy environment, earphones or telephone handsets would be more effective. Master controls are likely to be placed in guard offices, which are likely to be noisy in emergency situations.

4. Private and Shared Phone Lines. In two of the three buildings using phone systems, each of the staging areas had a phone with its own private phone line. In one building, the staging areas shared a single line. Neither approach is clearly or consistently superior.

Shared lines have two problems. If the receiver of any extension phone is off the hook prior to the fire, the occupants will be unable to dial a number at all the other extensions. While this is unlikely to happen if the high quality phones are installed properly and where they can be easily seen, we did observe this problem in the Bemidji Staging Areas. The second potential problem is the confusion possible when several people, under stress, try to share a phone line, especially if they are unaware that they are sharing one phone line and do not know beforehand with whom they are sharing it. If the potential users are properly trained, this should not be an important consideration.

The advantage of using a shared line **is** that it simplifies the operation in the office receiving the calls. With a shared line it **is** feasible to keep the line open throughout the fire until all are rescued; it would tie up only one phone line in the receiving office. This would avoid the need for a large number of phone calls to and from the individual staging areas.

Private lines for each small staging area with sophisticated conference calling capability at the receiving office would be a high quality solution.

5. Training: Staff. For all systems, except Bemidji, there is a guard office or other location that has the master controls for the intercom system or that receives the phone calls. For the systems we observed, personnel assigned to the locations could be trained in the systems very quickly and easily. They were designed to be easy to learn and easy to use. It is still an administrative challenge to assure that all personnel assigned to these locations, including relief personnel, are fully trained in the operation of a system that is very seldom used, no matter how quickly the training can be done.

C. SIGNS

In the Minnesota buildings, there were signs outside each small staging area showing its location; these signs were visible from a distance. In the Washington buildings the signs tended to be placed parallel to the corridor walls much like a typical sign at the entrance to an office; they were not visible from a distance. There were no signs for the large staging areas, each of which comprised a very large area.

Except for the signs in the Bemidji and Toledo Buildings informing the occupants how to use the phone, there were no signs or instructions in the staging areas of any building that would have informed the occupants seeking refuge about what to do or how the available hardware (e.g, phones and doors) operated. Similarly, to the best of our knowledge, no written material was distributed that would provide this information.

The need for signs was expressed by officials in both the Pension and Cohen buildings.

We are unclear **as** to what extent the GSA and the tenants are responsible for installing signs. It is possible that responsible officials are also unclear. In any event, there were few signs in the building that relate to the staging areas beyond the signs just outside each staging area showing its location. The issue of installing more signs needs to be addressed.

D. PHYSICAL FEATURES OF SMALL STAGING AREAS

1. Size of Small Staging Areas. Some of the small staging areas are quite small, too small to be comfortable. Some of the employees we interviewed expressed feelings of claustrophobia in such small quarters. Specific recommendations about minimum sizes and possible retrofits require additional investigations which are beyond the scope of this project. If additional staging areas are to be installed, there will be a need to establish design guidelines (e.g., ceiling heights, vision panels, as well as minimum floor space) that will minimize this problem.

2. Multiple Use of Small Staging Areas. All the staging areas in the Bemidji building are small areas of a floor that serve both the elevator and a stairs. In the Toledo Building all the staging areas serve as the elevator lobby. In the normal operation of the building, the staging areas of both buildings are an integral part of the circulation system of the buildings. In the Whipple Building all but one of the staging areas are lobbies (or small areas of a floor) that serve the service elevator. Again, in the normal operation of the building, these staging areas are an integral part of the circulation system of the building although the average employee would not use it frequently.

In the Whipple Building and all three Washington buildings at least one staging area is a small room reserved solely for use as a staging area. For example, five of the **six** staging areas in the Pension Building are used only as staging areas. However, the sixth, which is architecturally similar to the others, is used to exhibit a model of a monument. This raises the question as to whether or not such rooms should be permitted to serve multiple purposes. We believe that small staging areas may serve other functions--in addition to being a lobby or passageway--if

those functions are carefully selected and the staging area is properly designed. Prior to the development of guidelines, this should be permitted only when there is a mandatory review of the selection of the additional use and of the design.

Multiple use of the staging areas can make the areas more cost effective, will enhance the familiarity with the locations, and will permit the use of areas that are sufficiently large to be comfortable.

3. Seating. None of the small staging areas had chairs or other furniture that would permit comfortable seating during our in-depth visits. **A** majority of the potential users are assumed to be ambulatory and not users of wheelchairs or similar devices, Most of these ambulatory occupants do have physical impairments that would make it difficult for them to stand for any period of time or to sit on the floor. It is obvious that installation of some seating arrangement would encourage the area's use in a drill and in an emergency. The installation of seating is a high priority item. During an October 1991 visit to the Cohen Building, there were two old unmatched chairs in the one small staging area.

E. LOCATION OF STAGING **AREAS**

1. Windows. In discussing the concept of staging areas with disabled federal employees, a few emphasized the value of having a window in the area. All of these respondents had offices on floors that were within easy reach of fire department ladders. We interpreted their comments to mean that they want a trustworthy means of communication with the outside and a means of leaving the building. That is, if all else failed, they wanted the possibility of signaling their plight through windows, and they wanted the fire department to have the option of rescuing them through windows.

Each of the six buildings studied had at least one "room" designated as a small staging area: this room had a special ventilation system, a "two-hour" fire separation from the rest of the building, and a telephone or intercom to communicate with the outside. In two buildings all the small staging areas were in basements. In three of the remaining four buildings none of these small staging areas had a window. Furthermore, we did not notice any suitable alternative locations that did have a window. In the Pension Building, four of six small staging areas had a large window facing the street. On the other hand, each of the large staging areas in the **VA** and Cohen buildings had numerous windows facing the street.

We assume that the small staging areas will provide safety with a fair level of reliability but there is a small chance that the fire protection features will not operate properly. The desire voiced by some disabled occupants for windows, as a backup, appears to be reasonable. On the other hand, staging areas in basements will not have windows of the type requested, and often it will not be practical to build small staging areas on upper floors with windows.

2. Whipple Building. The staging areas in the Whipple Building were all small and near the service elevator. The service elevator could be used to evacuate the disabled building occupants but a fire department officer expressed a reluctance to use this elevator because it

depended on the electrical power system of the building with no emergency backup. A stairway emptying into the first floor lobby was nearby, say, 50 feet away.

3. Bemidji Building. The staging areas in the Bemidji Building all served as the lobby for the only elevator and the main stairway. There are doors to offices off this "lobby." Except for the basement area, they all were near an "outside wall," but providing the staging areas with windows would be difficult and expensive.

4. Toledo Building. The staging areas in the Toledo Building are the elevator lobbies. The only room off each lobby is a ladies room. The basements are used only by the maintenance staff and parking. Because the building is on a hill, we assumed that there are at-grade exits from the basements.

5. Pension Building. All the staging areas in the Pension Building were near stairways and as remote as possible from the two banks of elevators. There is no staging area in the basement, which is not open to the pubic. Four of the six staging areas have windows.

6. **VA** Building. In the **VA** Building, all small staging areas were in the three basement levels. All were near stairways. On the highest level of the three basement levels, the staging areas were also near exits to the "outside" but it is necessary to ascend a flight of stairs outside the building to get to street level and satisfactory safety. It appears that the staging area on the North side of the uppermost basement area could have been constructed to include the lobby to the outside at modest, if any, extra cost; we believe that this would provide an increase in actual safety and a significant increase in apparent safety.

7. Cohen Building. The Cohen Building has only one basement and a single staging area in this basement. It also has exits to two tunnels to other buildings. On the East end of the Main Corridor of the basement is a tunnel to the Humphrey Building. The tunnel wall has no doors to any space in the Cohen Building. There is no staging area in this end of the basement: disabled occupants can use the tunnel to the Humphrey Building if the security door is open.

On the West half of the Cohen Building--not far from the center of the main hallway--is a passageway to the Switzer Building. There are occupied rooms with doors off this passageway. The staging area is not far from this passageway. The presence of occupied rooms off this passageway somewhat increases the otherwise slight probability that this passageway will not be usable. The passageway does have a security door which is closed at night and weekends. Providing a small staging area in this part of the basement and not in the North part appears to be appropriate for providing protection during normal office hours.

During normal business hours, a guard controls the flow of people into the Cohen building from each tunnel. At other hours there is a closed security door for each tunnel that can be opened by a security officer on the third floor who can monitor the area using a TV system. Access to the Cohen Building is carefully controlled at all times, and we were not provided with any information that would assure us that the security doors in the corridors would be opened in a fire emergency that occurred nights and weekends.

The staging areas are placed so that disabled building occupants may have to travel a substantial distance in order to arrive at a staging area; the primary concern appears to have been to provide a route to the staging areas with no steps. Whether or not these distances are excessive is a matter of judgement. None of the disabled occupants we interviewed volunteered that the distances were too long. (Note that the most severely disabled occupants are likely to have wheelchairs or similar devices.)

F. VENTILATION SYSTEMS

Considerable effort and expense were expended to provide fresh and moving air to those seeking shelter in the small staging areas. Dedicated ventilation systems were installed. It is our understanding that these dedicated systems did not have emergency backup power. We do not know what effect, if any, the loss of electric power would have on the entry of smoke and heat into the staging areas--that is being studied in a separate part of the total study. However, it can be assumed that the lack of fresh air and moving air would greatly disturb those building occupants who are in the small staging areas and would increase their level of stress. When the level of stress is high, the quality of decisions made is degraded--people under stress focus on only part of the total situation. This could lead to unsafe acts, especially if smoke, or even the odor of smoke, gets into the staging area. We recommend that the ventilation systems be designed so that there is a very high probability that they will continue to operate throughout the fire.

In some buildings, staging area occupants could hear and/or feel the ventilation systems operate. **A** few persons volunteered that this feedback was reassuring, and could be included as a design feature of such systems.

The building occupants should be informed about the ventilation system as part of the effort to make the staging area concept acceptable to the building occupants.

G. LIGHTING

Emergency lighting is, of course, needed. The only problem we found with the emergency lighting provided in the small staging areas was that the lighting may be too dim for some persons to easily read signs.

Some of the small staging areas are essentially special rooms dedicated to use as a staging area. The lights in these rooms may not be on at the time a fire alarm is sounded: the users must turn on the lights. In some cases, the light switch was located outside the staging area. This makes the switch harder to find and, also, makes it possible that someone outside the staging area might turn off the lights. The battery powered emergency lights operate only if the building's electric power is lost.

Acceptable solutions would include: connecting the alarm to turn on the lights when the alarm sounds or when the automatic folding doors are closed or in alarm mode; having emergency

lights that are on whenever the main lights are not providing light; and installing sensors that detect the presence or movement of people in the area.

IX. COORDINATION WITH FIRE DEPARTMENT

Staging areas are designed as temporary refuge areas. They are to be used until the occupants with a disability can be evacuated to a safer area, such as a place outside the building. Normally the fire department is the only organization with the resources and skills to conduct the evacuation of the occupants of the staging areas. Clearly, the evaluation of the safety provided to building occupants by staging areas must include the likelihood that the fire department can and will respond effectively. In our study of six buildings with staging areas, building managements had not considered the problems in rescuing people from the staging areas. They implicitly assumed the fire department would be prepared to handle the challenge. While the fire department would undoubtedly attempt such an operation as part of their normal search and rescue activities, pre-fire planning would increase the effectiveness of the operation and decrease the risk to both staging area occupants and firefighters.

Fire departments that are well funded and have full time salaried firefighters will often develop pre-fire plans for major buildings in their jurisdictions. In addition, the firefighters in the closest fire stations will walk through the buildings to familiarize themselves with the building layout and with any special features. In such jurisdictions, simply informing the fire department of the existence and design of the staging areas may be the only action needed by the building management to assure that the fire department will properly respond to the needs of those using the staging areas in a real fire.

Most major cities have problems with crime, poverty and lack of money. Crime means arson fires. Poverty areas have large numbers of fires. The downtown fire stations respond to many fire alarms. The lack of money means that there are only the minimal number of fire stations. In downtown areas each fire station is the "first-in" station for many large buildings. The fire department may conclude that they do not have the resources for developing detailed pre-fire plans and conducting orientation visits. If there is no detailed pre-fire plan there, of course, will be no pre-fire plan for evacuating occupants with disabilities from the staging areas. If there is no pre-fire planning, the firefighters will arrive at the fire with no knowledge of the staging areas. In some locations, the building management must take the initiative in assuring that the fire department is aware of the staging areas.

In any event the proper time to first alert the fire department is during the design stage. That will give the fire department the opportunity to make suggestions for improving the design and assuring that the design is consistent with their operating procedures. For example, in the Bemidji Building, the occupants using the staging areas were instructed to call 911 to make contact with the fire department. However, at the time of our visit, the operators handling 911 calls were from the police department and they had no knowledge of the staging areas and had no means of direct communications with the firefighters at the fire scene. Solutions may not be difficult or particularly expensive, but cooperation is needed to make officials aware of the potential problems.

X. OPERATIONAL INTEGRITY AND PROMOTING CREDITABILITY

A. PROMOTING CREDITABILITY

Staging areas should meet the safety needs of the building occupants who cannot easily and safely ascend and descend stairs. *Also,* the staging areas should meet the psychological needs of the potential users and this requires that they have confidence in the safety of the staging areas in a real fire. If the users do not have confidence in the safety of the staging areas, they will not use them, they will fight for an acceptable system, and their fears and anger will hurt worker morale and productivity.

The first step in developing creditability is to have a system worthy of the trust of the building occupants, a system with operational integrity. We are happy to be part of a program that is designed to provide such a system. However, having well designed, carefully constructed and properly maintained staging areas is not sufficient to engender confidence.

When staging areas are installed in existing office buildings, it is important that whenever a staging area is not operational, that fact should be made clear. *As* is discussed below in the section on Period of Construction, signs were installed while the staging areas were not yet completed and the signs were not covered. **A** clear message was given, unintentionally, to concerned employees that these signs were not to be trusted. Furthermore, there may have been an implication that the total system was not to be trusted.

We cannot state too strongly or repeat too often that it is important to inform the building occupants about the characteristics of the staging areas in order to engender their trust in the safety of the staging areas. For example, the workers in the building should be informed that each of the small staging areas has a special ventilation system to supply the staging area with clean outside air and when it is cold outside, the air is heated.

The staging areas are part of a total fire safety system. Employees will have confidence in the staging areas only to the extent that they have confidence in the total system. Ways of engendering and maintaining this confidence include: keeping the fire plan and list of monitors up to date; giving the new monitors needed training; and keeping the staging areas freshly painted, and clean and free of temporary storage.

It is not only the employees with disabilities that need to be convinced that the system works. One official responsible for the fire emergency plan was delaying including the staging areas in the building fire plan until he could obtain technical information that verifies that the system does in fact provide the presumed level of safety.

B. OPERATIONAL INTEGRITY OF THE SYSTEMS

1. <u>Need for Operational Integrity</u>. When the disabled building occupants are asked to seek temporary refuge in a staging area, they are being asked to trust that the hardware in the

staging area will provide protection from the fire; that is, they are being asked to trust that the fire protection features will work during a fire emergency. Once they have committed themselves to the protection of a staging area--especially a small staging area--they might have forfeited their chance to use an alternative approach.

Some of the disabled employees we interviewed appear to be aware of this when they emphasized the importance of a window in the staging area. (See the section on Location of Staging Areas.)

The problems described in this document indicate that the systems as installed did not provide a satisfactory level of reliability and safety on the days we visited. We assume that improvements and corrections are being made.

2. Maintenance of Systems. The specially installed hardware features of the staging areas are not part of the normal day to day operation of the building. If any hardware components are in need of repair, it is unlikely that this will be apparent or reported during the normal operation of the building. Special maintenance procedures are needed to assure that the all components of the system will perform properly in a fire emergency.

The General Services Administration is a large organization. Its major responsibility is to operate, at minimal cost, a large number of buildings with widely varying characteristics. We believe that it **is** a true organizational challenge to develop, introduce and maintain, over a period of many years, a system that will guarantee the operational integrity of the staging areas. This is especially true of systems that are not integral to the normal functioning of the building. Of course, this can be accomplished if it is given a sufficiently high priority. The installation of additional staging areas (and even the long term use of the current ones) should not be considered until this challenge is addressed.

3. Period of Construction.

Serious fires in office buildings are relatively rare events. They are more likely to occur during periods of construction and renovation. We did not get the feeling that extra precautions were taken to assure the safety of the building occupants during the construction of the staging areas. We recommend attention be given to assure the operation (or sealing) of the staging areas in the **VA** building during its renovation.

Signs were installed in some buildings designating the staging areas while the staging areas were being constructed and, also, were visible after the staging areas were constructed but before the full system was operational. Use of the staging areas during this period might be hazardous. Each of these signs should be covered until it is safe to use the associated staging area. This is not only a safety measure but it also increases the creditability of the staging areas and the entire fire safety system. (See section on Promoting Creditability.) It should be pointed out that we found no instance where the building occupants were encouraged to use the staging areas before the responsible officials were satisfied that the areas were safe to use (other than the presence of the signs).

XI. SUMMARY OF PROBLEM **AREAS** AND RECOMMENDATIONS

Fire Emergency Plan and Training

A "Designated Official" is responsible for developing the occupant emergency plan, and selecting and training occupant emergency organization members. More assistance should be given to Designated Officials for them to be able to perform these tasks adequately.

Training aids would be helpful. Some viewgraphs and diagrams should apply, unchanged, in a good percentage of buildings with staging areas.

Existing Occupant Emergency Plans based on guidance from the GSA document "Occupant Emergency Program Guide" were good from the standpoint of establishing an organizational structure for emergency situations. However they were not designed to provide useful information to the typical building occupant. **A** document should be distributed to each employee that describes the fire emergency plan in simple language. Information regarding staging areas needs to be added to the Occupant Emergency Plan or a separate document regarding staging areas needs to be created.

Employees (called floor monitors, area monitors, etc.) who are assigned responsibilities in emergency situations need more assistance to perform their duties, e.g., formal training, group discussions, and feedback discussion sessions immediately after drills. Employees with disabilities need to be kept current as to who is assigned to assist them.

Employees with mobility impairments need to be instructed on the operation of the safety features of the staging areas and told how they provide safety. During our visits we did not find any such training underway or planned.

Potential users of the staging areas must have confidence in the safety of the staging areas. To build confidence, employees should be given information on the staging areas features as, for example, the existence of a special ventilation system to supply the staging area with clean outside air. Care must be taken not to destroy confidence in the system by, for example, having uncovered signs visible during the construction period and before the system is fully operational. Use of the staging areas during this period might be hazardous.

See the appendix of this report for detailed guidance in developing and evaluating fire emergency plans and in implementing them.

Coordination with the Fire Department

Building management must inform the fire department of the existence and design of staging areas. The fire department should be alerted during the design stage to give it the opportunity to make suggestions for improving the design and assuring that the design is consistent with their operating procedures. Staging areas should be included in the pre-fire plan and familiarization visits of the fire department.

<u>Nature of the Staging Area</u>

Some of the staging areas are too small to be comfortable or prevent employees from feeling "trapped."

Some small staging areas may serve other functions, in addition to being a lobby or passageway, if those functions are carefully selected and the staging area is properly designed.

Occupants with mobility impairments expressed the view that they would like to have a window in the staging area. It is anticpated that this will often not be practical.

During our in-depth visits, none of the small staging areas had chairs or other furniture that would permit seating. Seating is needed for ambulatory occupants who have physical impairments that would make it difficult to stand for any period of time or to sit on the floor.

<u>Building Features</u>

1. <u>Doors</u>. Doors in fire barriers that had self-closers were kept open with wedges, etc. Self-closing devices should be replaced with automatic closers that will close the doors when the alarm sounds or power in the building is lost.

There are problems with the automatic folding doors as installed in the small staging areas in five of the six buildings. They do not have a viewing panel to provide the visibility outside the staging area which could decrease the anxiety of occupants awaiting rescue. The doors have a safety feature to stop the closing of the door when the door encounters an obstruction such as a slow moving person. This feature was not operating properly. (The manufacturer has informed us that this and other safety related problems are being corrected.) The alarms associated with these doors should be properly deactivated (so as not to interrupt other associated safety features) or made much less intrusive. Their loudness would cause severe communication difficulties.

2. <u>Communications</u>. For buildings with large staging areas, procedures must be developed to provide occupants with disabilities with the information as to which of the large staging areas they should go. (One may contain the fire.)

A phone or intercom system within the staging area, while not needed for the physical safety of those seeking refuge, would greatly add to their psychological comfort, and the information given the fire department by the occupants of staging areas could affect the priorities of actions by the fire department. The use of the phones or intercom is sufficiently complicated that informational signs and training of occupants for the setup particular to their building is needed.

If the communications systems are to function effectively, both the staging areas and the receiving office must be sufficiently quiet for the communicating persons to hear each other.

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More noise can be tolerated if phones rather than intercoms are used. Sounding alarms can make the systems useless.

3. Signs. Signs should be included as part of the installation provided by **GSA** or, at least, guidelines for installing signs should be provided by **GSA.** If **GSA** provides the signs, the Designated Official should have the authority to add to or modify the signs.

Signs should not be visible until the staging area is fully operational.

4. Ventilation systems. Ventilation systems for the staging areas should be designed so there is a very high probability they will continue to operate throughout the fire. **A** lack of fresh air and moving air would most likely disturb occupants of the staging areas.

5. Lighting. Lighting for the small staging areas could be improved by connecting the alarm to the lights so that when the alarm sounds some light is automatically provided. This could be the regular lights with emergency backup. The emergency lights would be a possible alternative in some situations.

Systems Approach

The study of staging areas in six Federal buildings clearly demonstrated the importance of taking a systems view of staging areas throughout the design and implementation phases. The systems view needs to be based on a solid understanding of how staging areas will be used, that is, the life safety strategy that underlies the entire system. With such a systems view, numerous errors in hardware design might have been avoided. Similarly, emergency coordinators need to base their plans on the same life safety strategy. For example, a systems view could have helped emergency coordinators to identify and address problems such as failing to communicate with occupants inside staging areas or planning on how and when they might be rescued.

APPENDIX

HUMAN FACTOR GUIDELINES
FOR THE DESIGN AND USE OF STAGING AREAS

INTRODUCTION

These guidelines are based on criteria originally developed to study and evaluate the use of staging areas installed in six Federal buildings. These staging areas were designed to provide temporary refuge to persons who cannot quickly or safely travel down stairs. The research findings yielded insights that are useful to the design and operation of staging areas. Additional details about the staging areas and the findings of this study are found in the main body of the report of which this document is an appendix.

The effective use of staging areas inevitably depends on human action and attitude. The study of the six buildings revealed the type of difficulties that can be expected when staging areas are designed and plans conceived without detailed consideration of the human factors involved in their use. More importantly, many findings of the study are useful as a preliminary guide to anyone charged with the development and implementation of emergency plans covering the use of staging areas. Other professionals will find these guidelines helpful in designing and maintaining staging area systems.

The scope of the study was limited to only **six** buildings. There is no doubt that all the solutions to potential problems are not provided. For example, high rise buildings were not represented in the **six** Federal buildings. Therefore, caution should be exercised in generalizing these findings to other buildings and installations. Applying a systems approach to tailoring hardware design and emergency plans to particular buildings is the recommended practice consistent with the methods used in this study.

The guidelines are divided into basic categories covering the contents of a plan (e.g. selecting a basic strategy), its implementation (e.g. training), and the written plan disseminated to building occupants. Each guideline is illustrated with specific examples from the study. The purpose of using these examples is not to praise or criticize officials who did their best in a difficult assignment, but rather to help others in similar situations to profit from their experiences. The reader should keep in mind that the General Services Administration and the Designated Officials charged with establishing and maintaining Occupant Emergency Programs and Occupant Emergency Plans were pioneers; there were no experiences with previous installations that could provide information, guidance, or a list of pitfalls.

Our evaluation of human factors of staging area use was guided in part by a list of criteria. The criteria were derived from a broad systems view that integrates human and motivational factors along with the design of physical components of the staging areas. **A** systems view is unusually important in evaluating staging area use, because the actions taken by occupants remaining inside the building must **be** consistent with the hardware features designed to protect them. For this reason, the fire

protection features of the building, its layout, and the number, actions, and characteristics of its occupants are all considered to be components of the building's life safety system.

I. CONTENTS OF THE PLAN

A. SELECT ONE OR MORE BASIC STRATEGIES FOR PROTECTING BUILDING OCCUPANTS.

A "life safety strategy" is a basic approach or plan for protecting building occupants from exposure to the flames and smoke of a fire. Strategies can be expressed as short statements that describe the fundamental actions that people follow in a fire emergency. **A** few examples are: "Everyone in the building leaves using the nearest exit," and "The alarm alerts building occupants that they may need to evacuate. Floor monitors are notified when their respective floors should evacuate, using which stairway."

The fundamental criterion for selecting a strategy is a good "fit" between the strategy and the building, taking into consideration its size and layout, fire protection features and occupants.

Without guidance, many emergency coordinators will fail to carefully consider strategies for using staging areas. Five of the **six GSA** buildings used the strategy of total evacuation for mobile occupants using assigned stairways. This strategy is arguably simple enough to be implemented without much analysis. However, the safe use of staging areas presents a more complex problem, and requires some thoughtful analysis about how their use will best serve the building's occupants. **A** few examples of strategies specific to staging areas are: "Floor monitors direct all building occupants to the side of the fire/smoke barriers least likely to be affected by the **fire,**" and "Self-selected persons with disabilities and their 'escorts' report to the staging area. When reasonably safe, the fire department evacuates them using the elevators or stairs as conditions indicate." The degree to which these two strategies will "fit" a particular building differs considerably, along with the system components and procedures required to make them work effectively.

An example illustrates the importance of taking a systems view of a strategy's fit to all aspects of the building. Without exception, building officials and emergency coordinators in the studied buildings hadn't analyzed the problem of rescuing people from staging areas. They implicitly assumed that the fire department would be prepared to handle any related difficulties. While the fire department would certainly take charge of such an operation, pre-fire planning for such a potentially complicated operation would reduce the time and resources required, thereby decreasing the risk to both staging area occupants and fire department personnel.

The clear statement of a strategy is very important to the effective training of the emergency team and building occupants. Confusion will result if individuals are uncertain about what strategy to follow. People in the building need to know exactly who is supposed to do what. For example, depending on the building's configuration and its protection features, the occupants who are expected to use the staging area may vary from only a few persons entirely unable to use stairs (where the staging areas are small protected rooms) to all the

building's occupants (where fire barriers divide each floor into large compartments or staging areas with equivalent egress capabilities).

Having selected a strategy, some buildings may encounter problems assembling the necessary components. On occasion, emergency coordinators will be clear about how they can best use staging areas, but may encounter another obstacle that will limit their success. They may be frustrated because the components needed to implement the preferred strategies are not available.

One of the studied buildings illustrates this problem. The alarm system had been recently upgraded to address individual floors. The new system sounded alarm devices only on the "fire floor" and the two floors above and below. Consistent with this new capability, the emergency plan was changed from a complete building evacuation to a partial evacuation of only the fire zone. Difficulties resulted because the building lacked a public address system that could be used to explain the situation to occupants on floors not receiving the alarm. (Many occupants on other floors became aware of "incidents" when they faintly heard the alarm signal or attempted to use recalled elevators.) This difficulty is representative of problems that result when designers fail to take a systems view that encompasses human factors along with hardware components.

In this same building, the problem extended to strategies specific to protecting persons with disabilities. The emergency coordinator was unable to take advantage of large staging areas because communications components were unavailable. (See the discussion concerning maintaining communications between staging areas and control rooms, section **I.C.2.**) Therefore, they still used a strategy that did not take full advantage of the new installation -- persons with disabilities and escorts travel to unprotected offices (where communications are available) and wait to be evacuated by the fire department. If the monitors are informed that they are on the fire side of the fire barrier, they can move to a better location.

1.   **Develop clear guidelines specifying which building occupants are targeted to use which life safety strategy.**

In all surveyed installations involving the use of small rooms for staging areas, the plan was to target only persons with disabilities and other persons assigned to stay with them.

Self-selection according to a performance criterion is an effective and nonpatronizing approach to targeting. Issues of sensitivity to persons with disabilities impact the approaches that building management can use to identify targeted building occupants. For example, in one building, we were told that the personnel department had declined to identify persons with disabilities. Some emergency planners were aware that identifying such persons could create "political" difficulties. Therefore, emergency planners generally preferred to allow persons to select themselves as candidates using performance criteria. *An* example of a criterion was that "persons who would significantly impede the progress of other occupants' travel down stairs should use the staging rooms." Thus, persons with hidden disabilities (e.g., knee problems) and temporary disabilities (e.g., a broken leg) would be included, while persons with disabilities that do not impede progress (e.g., sensory impairments) could exclude

themselves. There were no reported instances where a permanently disabled person who clearly could not descend stairs failed to identify him or herself.

2. **Develop clear guidelines specifying the events that initiate the use of staging/refuge areas.**

    In most surveyed buildings, the plan called for the use of staging areas whenever the fire alarm sounded.

    Many persons with disabilities want the option of leaving the building or remaining in the staging areas. During interviews, some occupants with disabilities expressed uncertainty about whether they would choose to use the area during an actual fire. These occupants felt that they were capable of using stairs during a fire emergency, either by their own means or with assistance from escorts, but that this might cause an increase in risk of injury and/or discomfort. These same occupants highly valued staging areas during fire drills, because they could fully participate in the fire drills without assuming the risk of descending stairs. Many also expressed doubt about the reliability of the staging areas even after the features had been explained.

    Providing the option has pro and cons. On the positive side, the option greatly simplifies the routine management of the fire plan for both emergency coordinators and persons with disabilities. Further, with good communications, the added flexibility could result in fewer people needing rescue during an actual emergency. On the negative side, there is some risk that persons who use staging areas assuming that there is a drill, may later choose to evacuate. **A** delayed evacuation coupled with their generally slower travel speed would significantly increase their risk. (Good training and communications would greatly reduce the risk of a delayed evacuation.)

B. **MAKE SURE THAT THERE ARE COMPONENTS THAT ENSURE THAT TARGETED PERSONS WILL USE THE STAGING/REFUGE AREAS.**

There were no reported problems with nontargeted persons preferring to use small staging areas instead of evacuating the building. In view of the often cited preference for leaving the building, we think it unlikely that the problem will arise in future installations. (It is assumed that in very tall buildings evacuation will be to other floors of the building.)

The staging area could provide safety to any occupants trapped during an actual fire. During the evaluation, a few persons suggested that all building occupants should learn about the rooms so that they could use them should they become trapped inside the building. In view of the generally low occupancy rates in office buildings, coupled with the success of evacuating occupants in nearly all likely fire scenarios, providing this option was unlikely to pose a threat of overloading staging areas in the surveyed installations. Thus, staging areas, with their communications and refuge capabilities, could be a life saving backup in the rare event where unimpaired occupants are unable to complete the primary strategy of evacuating the building. However, it is important that training stress that staging areas are strictly a backup strategy (which should not be a difficult problem considering the strong preference for leaving the building).

1. **Develop means to identify permanent building occupants.**

   The use of a performance criterion should elicit a high level of voluntary cooperation. In the surveyed buildings, hidden disabilities seemed more prevalent than apparent disabilities. The visual identification of permanent building occupants, who cannot safely descend stairs, is likely to miss many persons who would benefit from staging areas. But, in the studied buildings where building occupants were asked to identify themselves, no problems of obtaining relevant information were reported. For example, in two surveyed buildings, persons with hidden disabilities (e.g. back or knee problems that made descending stairs slow and hazardous) expressed appreciation for having the staging areas. We also received reports that persons with temporary disabilities asked to be placed on the list of staging area users. In a few buildings, attempts to identify candidates for staging areas had not been undertaken in the belief that none of the occupants had relevant disabilities. However, closer inquiry revealed that hidden disabilities could easily have passed unnoticed.

2. **Develop means to identify visiting building occupants.**

   Emergency coordinators will need to develop procedures for guiding visitors to staging areas. Targeting of visitors was not well-addressed in any of the buildings. Many coordinators felt that they did not have "handicapped visitors," because there were no or few public offices. However, closer examination revealed that visitors with disabilities were far more commonplace than had been thought, largely because many disabilities are hidden. In one building, the elevator was not operating the morning of our visit, so an elderly couple was forced to climb four flights of stairs. They "needed half-an-hour to recover." In another building, a mobility impaired person was visiting a public official when the fire drill was conducted. The public official had been involved in the staging area installation process, and therefore was able to both accompany the visitor to the staging area and explain its safety features. Thus, even buildings lacking offices that directly serve the public often have visitors, many of whom may have hidden disabilities that preclude their easy and risk-free use of stairs to leave the building.

   One of the studied buildings had large numbers of visitors due to its historical and architectural significance and the presence of a public museum. Unescorted visitors could travel freely around the ground and second floor. Visitors on tours might be found on any floor of the building. In this, as well as any building with significant numbers of visitors, provisions need to be made to identify and direct persons to staging rooms if they cannot safely descend the stairs. The tour guides and others in the building with public contact need specialized training. While signs and announcements can alert visitors to the existence of staging areas, such measures, by themselves, are insufficient. Persons likely to have public contact will need to be trained to clearly and rapidly explain the capabilities of the staging areas if visitors are to feel confident of their safety.

3. **Establish whether there is a need for escorts or monitors to remain in staging/refuge areas.**

Escorts or monitors may be useful even where persons with disabilities don't need hands-on assistance. The desirability of having escorts or monitors was discussed in a number of buildings. The need for company was important to some persons; they did not want to stay in the areas alone. A few persons reported that being alone did not make any difference to them. Apart from this issue, having someone else in the room may be helpful for operational reasons. Conditions permitting, the escort or monitor can function as a "runner," backing up the communications hardware installed in the staging areas.

Depending on the building, emergency coordinators can use either "escorts" or "monitors" to remain in staging areas with persons with disabilities. "Escorts" can be defined as "buddies" with one-to-one assignments to persons with disabilities. "Monitors" are assigned to specific staging areas to remain with whomever occupies the area. In some surveyed buildings, escorts were optionally assigned according to the wishes of persons with disabilities. Thus, on the roster for the emergency organization, many of the targeted persons were identified as "escort not needed." The nature of the disabilities didn't seem to be the determining factor, since all persons with disabilities could travel unassisted to the staging areas. Rather, it seemed to depend more on an individual's level of distress at remaining in the staging area alone. In other surveyed buildings, monitors were assigned to the staging area irrespective of the individuals who use the area. Our observations failed to reveal any strong advantage between the approaches; both worked well provided that the approach was supported and maintained. However, each approach has relative strengths and weaknesses. (For example, the escort approach may be more reliable where buildings have poorly maintained emergency teams. But escorts may delay their own evacuation while searching for their assigned co-worker who is away from his or her customary work location.) Emergency coordinators could select one or both approaches, whatever better serves their particular circumstances.

4. **Ensure that targeted persons will find the staging/refuge areas acceptable.**

Many persons who are unfamiliar with the staging area features will be very skeptical about the safety provided. Because our visits were conducted before the buildings had fully installed their revised plans, it is difficult to judge how successful they might have been in informing building occupants about the capabilities of the staging areas. However, it is typical of building management, even those with well designed plans and emergency teams, to neglect to train building occupants *at large* beyond the conduct of exit drills. This is probably sufficient where occupants leave the building. However, when the plan asks that people remain in the building, their confidence that safety will be provided may affect their willingness to comply, and will certainly affect their psychological comfort.

Clear information about the safety features of staging areas will be needed to instill confidence among persons expected to occupy them. The positive effect of

information on confidence was repeatedly and dramatically demonstrated during our interviews. In many cases, persons with disabilities knew nothing apart from the fact that staging areas had been installed, and expressed considerable skepticism about whether staging areas really improved safety. However, after we explained the hardware features, most expressed a willingness to use the staging areas and an appreciation that the staging areas had been installed.

Problems with the design of lighting could cause serious difficulties. In a few small staging areas, light switches were installed outside the staging area. The switches were hard to locate and prevented occupants from controlling the lighting without opening the door. This also creates the possibility that someone outside will turn off the lights leaving staging area occupants in complete darkness (emergency lighting will not operate unless the electrical power is lost). On the other hand, if the light switch is inside the room, the automatic closing door might close before the light is turned on. These problems can be minimized by informing employees with disabilities and monitors of the locations of the switches and having them actually practice using the wall switches. **A** better approach would be to have hardware activate the lights whenever the door **is** closed or whenever the alarm **is** activated.

A lack of seating in staging areas will limit the usefulness of future installations. Persons occupying staging areas may have to wait for some time, and their needs for physical comfort should be addressed. We did not observe any seats in the small staging areas during our indepth visits. Many targeted individuals have mobility problems with walking, and either standing for a extended period of time or sitting on the floor can be very uncomfortable and pose a risk of physical injury. Several persons had plans to bring chairs to staging areas for their own use. Simple fold down benches would alleviate much of the problem, while neither reducing capacity nor creating a hazard.

Very small dimensions of some staging rooms will induce anxiety in some staging area occupants. In a few buildings, some of the staging rooms were very small. **A** number of persons with disabilities expressed concern that they would feel "trapped" or "panicky" in so small a space. None of these people described themselves as being "claustrophobic" *per* se.

C.   **IDENTIFY AND INSTALL THE COMPONENTS THAT WILL ENSURE THE SAFETY OF PERSONS WHILE OCCUPYING THE STAGING AREAS.**

    1.   **Ensure that the staging area is designed and maintained to reliably protect occupants long enough to complete the life safety strategy.**

        Without specific information from designers about staging areas and the associated hardware components, building officials and emergency coordinators may not know enough about the protection features of staging areas to make crucial decisions. In our study, building officials and emergency coordinators understood the rudimentary features of the staging areas, but were largely unfamiliar with the design and operational features. For example, most knew that there was a separate "ventilation"

system, but few knew whether backup power had been supplied or that the system was designed to keep smoke out of small staging areas by maintaining positive pressure. Moreover, in buildings where staging areas were served by stairs or elevators, none knew how well the system could maintain positive pressure in staging areas when the elevator or doors were opened. Such information could be of critical importance, especially to the fire department, when making decisions about when and how to rescue staging area occupants.

2. **Ensure that the communications capabilities are sufficient to maintain contact between the control center and occupied staging areas.**

Intercoms and telephones used to communicate with staging areas were sometimes isolated from the control center. In some buildings, the intercom or telephone used to communicate with staging areas was located in rooms or areas physically isolated from the area where building officials and fire departments were likely to run their emergency operations. In one building, the intercom was located in a central atrium, but could have been located at the guard station in the building's foyer. In other buildings, the communications terminus for staging areas was not in the building, but rather in remote buildings. Locating communications in an isolated location creates an important problem: an added communications link is created because information must be relayed from the communications terminus to the actual control center, thereby reducing reliability and losing valuable time. In addition, communications to staging areas may be in a remote location in the same building where manning the communications terminus requires that an individual be dedicated to that role. This assignment can be easily overlooked and dedicating a person to that one assignment is a poor allocation of resources.

Staging areas should have communications capabilities at all hours. In most office buildings, occupants work at times other than normal working hours. During these times, buildings are often most vulnerable to serious fires because they can burn unnoticed for long periods of time. Therefore, persons in staging areas should be able to alert someone to their presence at any time.

In smaller buildings, the two goals of maintaining around-the-clock communications and locating communications equipment at the control center can conflict. Smaller buildings may not locate personnel in the control center area at night and during weekends and holidays. **A** possible solution is to install staging area phones that can be used to both communicate with the control center and dial an emergency number when the control center area is unoccupied.

Background noise levels in control rooms or staging areas can cause total communications failures. Alarm bells in control rooms were a fault common in many of the surveyed buildings. While sounding, these bells made verbal communications with staging areas very difficult if not impossible. Even if it were feasible to talk over intercoms, someone in the control room would be unlikely to notice an attempt by a staging area occupant to contact the control room. The problem could be mitigated by substituting telephone receivers for intercom speakers and by using a loud "ring" to signal incoming calls. However, a simpler and more

effective solution would be the removal or immediate silencing of the alarm in the control room. Some fire safety experts recommend against silencing control room alarms because a silenced alarm can be ignored by the security staff without taking action to investigate its source. However, if building personnel are so poorly trained that they fail to take simple actions, then they are unlikely to complete the far more complex procedures needed to operate staging areas.

A problem similar to that caused by control room alarm signals resulted from the supervisory signal installed in the horizontal folding fire doors. The constant and loud buzzer made communications more difficult if not impossible. Because it may be desirable that some type of signal indicate that the door is operating in its alarm mode, an intermittent signal (e.g., a beep every 10 seconds) would be acceptable.

The lack of communications between control rooms and large staging areas significantly limits their usefulness and increases the risk to occupants. There was a lack of communications capability in one of the buildings where horizontal compartmentation (i.e., large staging areas) is used. This created a critical obstacle to their effective use. Without communications between the floors and the control room, the emergency planner felt unable to modify the plan to take advantage of the newly installed fire barriers. He could neither identify the safer side of the building, nor communicate this finding to the affected floors. If no dedicated system is provided, an emergency communication system can be designed using the building's telephone system.

3. **Develop procedures for transmitting status reports between staging areas and the control center.**

Emergency team members need to relay information about the presence of staging area occupants. In the survey, some buildings used floor monitors to relay information about staging area occupants to the control center. Two approaches were used. In one approach, monitors personally reported the presence of staging area occupants when reporting to the emergency coordinator in the control room, a procedure that would fail to identify anyone entering the staging area after the floor had been "cleared." Another approach obviously is needed if no one fills the monitor role. One surveyed building maintained its monitor organization well enough to reliably succeed in this approach. Other buildings planned to survey the staging rooms from the control center, an approach which would seem preferable wherever there are doubts about the quality of the monitor organization, but which depends on maintaining the procedures and hardware needed to communicate between staging areas and the control center.

Without explicit guidance, most emergency coordinators will neglect to plan for transmitting status reports between the control center and the staging areas. Once the initial census of occupants in staging areas was accomplished, none of the buildings had plans for transmitting status reports, although some emergency coordinators reported that reassuring staging area occupants was important. Periodic contact is also valuable as a means of monitoring any change in conditions (e.g.,

staging area occupants smelling smoke) that could help fire department personnel make tactical decisions.

Viewing panels would allow staging room occupants to safely assess outside conditions, but could increase the risk to poorly trained staging room occupants. Information about conditions outside staging areas could be important to both the fire department and staging area occupants of both small and large staging areas. The fire department could use reports to help prioritize rescue operations, **as** well as to achieve an overall size up of the incident. Staging area occupants might need the information to compare conditions inside and outside of the staging area. Such information is particularly valuable where horizontal exits divide floors into two large areas, so that occupants could keep themselves on the safer side. However, in none of the surveyed buildings could staging area occupants observe outside conditions without opening the door, thereby potentially exposing themselves to hazardous conditions. **This** possibility is particularly serious where horizontal folding fire doors are installed, since they can be neither opened slightly nor "slammed shut. Viewing panels would alleviate much of this problem (and might alleviate some feelings of anxiety by reducing the ambiguity of the situation).

However, without careful briefing, viewing panels could potentially increase the risk to staging area occupants. Persons might wait in the staging areas, but upon viewing smoke outside, decide to "make a run for it." (Under such circumstances, they would have been far safer to have not used the staging area in the first place.) However, we believe that this scenario would be avoided where people are confident that they are well-protected, and are aware that leaving the staging area when there **is** smoke outside usually exposes them to far greater risk.

D.   **IDENTIFY AND INSTALL THE COMPONENTS THAT WILL ENSURE THE TRANSFER OF PERSONS FROM THE STAGING AREA TO THE OUTSIDE OF THE BUILDING.**

Without explicit guidance, emergency coordinators will neglect to plan rescues from staging areas. None of the buildings had given much consideration to this important issue, generally assuming that the fire department would handle the situation. The fire department would in fact take responsibility. However, the speed and safety with which they can complete rescues depends on both their knowledge that such staging areas exist and accurate information provided by the building management. (See also the discussion about input from the fire department, section II.B.)

1.   **Identify and install the components needed to communicate the status of staging areas to persons responsible for rescuing occupants.**

Fire departments will need information about conditions in staging areas and potential evacuation routes (including elevators where feasible). None of the studied buildings had developed or practiced procedures for this purpose. While fire departments are likely to use their own personnel to evaluate conditions, information from staging areas could be critical to setting priorities. Moreover, if staging areas

occupants are unable to communicate with rescuers, they would be far more likely to risk abandoning the staging area when exposed to deteriorating conditions.

2. **Ensure that guidelines have been developed for making decisions about when and how to transfer persons from staging areas.**

    Many fire departments will be unprepared to make decisions about how and when to transfer persons from staging areas. While fire departments are trained to perform rescues, staging areas *per se* will be unfamiliar to most. Accordingly, fire department personnel may be unprepared to consider all the factors pertinent to deciding when and how to rescue staging area occupants. For example, the fire department, not realizing that staging area occupants are well protected, could endanger them unnecessarily by rescuing them before hazardous smoke has been cleared from corridors. *Also,* fire department personnel may not realize that they are rescuing a mobility-impaired person with an additional hidden problem who could be seriously injured unless certain carrying techniques and precautions are observed.

3. **Establish the qualifications of people who perform rescues, along with their training and equipment needs.**

    Many building officials will neglect to plan and coordinate the respective roles of emergency team members and fire department personnel. While some of the buildings had written plans designating certain personnel to operate elevators, such procedures were usually not practiced. Moreover, fire department personnel would be unlikely to assign building officials such responsibilities unless they were convinced that building employees had received appropriate training and were properly equipped. Nonetheless, building personnel could play a very significant role in "rescuing" staging area occupants, either before they are "trapped" or so that fire department personnel can devote more resources to hazardous rescue operations or suppression activities. Such inconsistencies are best addressed before a real fire. **The fire department should be asked to discuss rescue operations during their pre-fire planning process.** Moreover, there is no reason to waste building resources on emergency team training and equipment if it is certain that the fire department will forbid the participation of building personnel.

E. **REMOVE COMPONENTS FROM THE PLAN THAT ARE IRRELEVANT TO THE LIFE SAFETY STRATEGY.**

Some plans will contain extraneous elements that should be discarded. In most buildings, extraneous details were uncommon. Nonetheless, poorly tailored plans will often include features that serve little purpose. For example, the survey revealed a plan for a small office building which included a number of elements that were inappropriate. The plan called for announcing coded emergencies (e.g., "pink alert," "yellow alert two," "white alert") using a public address system, presumably for fear that accurately identifying emergencies might evoke panic. However, such codes are difficult to remember and panic is a very remote threat. Moreover, the PA system covered only a small portion of the entire building. The written plan was not only needlessly complex, but had never been implemented.

II. IMPLEMENTATION OF THE PLAN

A. ENSURE THAT THERE IS INPUT TO THE PLAN FROM THE EMERGENCY TEAM, FROM BUILDING OCCUPANTS AT LARGE, AND FROM PERSONS WITH DISABILITIES IN PARTICULAR.

Some emergency coordinators will have difficulty gaining needed cooperation from tenant organizations. In one surveyed building, the emergency coordinator was unable to gain sufficient support from tenant agencies to perform his job, despite his own high degree of interest and motivation. The difficulty seemed to have resulted in part from his relatively lower ranking in the management hierarchy than emergency coordinators in most other buildings, and from the overall low level of cooperation among Federal agencies in this building. In such instances, emergency coordinators may need higher authorities to intervene on their behalf and mediate any difference in opinions about the contents of plans and their implementation. In our survey, this would mean high ranking agency officials. In other settings, the fire department or building owners and managers might effectively intercede.

An explicit effort to solicit feedback will be needed to obtain input from the emergency team and building occupants in general. In one building, team members were asked to attend evaluation meetings after fire drills. During the meeting, input was actively solicited and successfully obtained from team members. Conversely, input from team members was rarely received in buildings lacking a formal mechanism to obtain such input.

The same principle applies to building occupants in general. Input from building occupants in general was weak in all buildings. Even in the building just mentioned, formal mechanisms for input did not extend below the level of floor monitors. Without such a mechanism, input will be received only from individuals who show an extraordinary amount of initiative. Nonetheless, regular occupants can provide helpful insights about improving the overall system, from noting areas where alarms are not clearly audible, to identifying team members who ignore their responsibilities, to inaccuracies in training materials and approaches.

Assertive persons with disabilities will sometimes complain about perceived problems, but sensitive and effective approaches are needed to obtain input from other persons with disabilities. In all larger surveyed buildings, at least a few persons with disabilities had complained about the perceived inadequacies of the provisions taken for their safety. But without an effort to solicit their input, less assertive individuals are likely to remain silent.

Input from persons with disabilities is needed not only for "political" reasons, but also because they know best what they can accomplish and how they can best be assisted. **A** simple policy could be instituted whereby all persons with disabilities are interviewed to both explain and demonstrate the staging areas, and to inquire about their needs for assistance during a fire emergency. However, care is needed to avoid imposing help where it is unwanted, because self-sufficiency is strongly valued by many persons with disabilities.

B. ENSURE THAT THERE IS INPUT FROM THE FIRE DEPARTMENT.

Emergency coordinators will need to actively solicit input from fire departments. Some fire departments have extensive pre-fire planning programs; others have less. The **GSA** staging areas are novel and few fire departments are aware of the **GSA** activities. It is important that the **GSA** emergency coordinators initiate contact with fire departments.

The response of fire departments when contacted by officials of the **six** buildings varied widely. Some fire departments responded with keen interest, actively participating in fire drills and discussing the details of staging area features and rescue procedures. In another jurisdiction, the fire department declined an invitation to meet with us, saying that they did not have the available time.

In instances where fire departments show limited interest, building officials will need to aggressively request fire department participation. Even where fire departments are clearly interested, their attention needs to be drawn to delineating their roles relative to building personnel, if only because they may be less familiar with the staging area strategies than building management.

C. MAKE THE TRAINING APPROPRIATE TO THE SKILLS AND MOTIVATION DESIRED IN THE PARTICIPANTS.

    1. Analyze whether the training techniques are appropriate to skills and audience.

        Many emergency coordinators will neglect to train building occupants when the procedures involve relatively few people. While many emergency coordinators were conscientious about running fire drills, many also neglected to develop procedures or to train building occupants where relatively few people were involved. This tendency was very evident in planning to use staging areas. For example, the use of communications hardware was omitted from all the reviewed plans. One surveyed building had an unusually well developed emergency plan, but still failed to practice communications with the staging area. Having not practiced with the equipment, the building personnel in the control room could not accurately explain the operation of the equipment. There were also no procedures for calling staging areas, or for having staging area occupants report their presence and conditions.

        Emergency coordinators can run whatever type of fire drill that best serves the purpose of practicing procedures while minimizing negative side-effects (e.g., work disruption, inconvenience). All the emergency coordinators were aware of the importance of drills in learning routes of travel, both to the exterior of the buildings and to staging areas. The degree to which occupants participated in drills was generally high, regardless of whether drills were announced ahead of time, announced at the time the alarm was activated, or not announced (i.e., a surprise drill). Since the primary purpose of drills is to familiarize occupants with travel routes and procedures, building officials can use whatever approach evokes the highest level of participation coupled with the least inconvenience and resentment.

Hands-on training is essential for remembering the operation of staging area hardware and procedures, and is needed for evoking confidence that the areas provide a high level of protection. Where building occupants need to learn procedures and operate equipment, there is no adequate substitute for actual practice. Verbal descriptions of procedures in themselves are unlikely to be recalled accurately, especially during the stress of a real emergency. The importance of hands-on practice was illustrated by some problems observed during fire drills concerning the operation of horizontal folding fire doors. In one surveyed building, the operation of the curtain type folding door had been verbally described to emergency team members. But during a fire drill, these same persons failed to even attempt to open the door on one floor, instead choosing to travel to a more remote but more traditional exit. A monitor was observed opening a folding door without problems, but when the door began closing, subsequent people failed to operate the door correctly, so that the opening progressively narrowed, restricting the flow of people through the door. Only when the door closed completely did anyone open it to its greatest width. This could have been avoided with a simple practice session wherein the floor monitors would operate the door in its alarm mode. Verbal instructions for such motor skills are a great deal less effective.

2. **Analyze whether the amount of training is appropriate.**

One or two fire drills per year will be sufficient for the building occupants in general. While some occupants will have not have participated in a drill, there will almost certainly be coworkers present who will explain procedures during an actual emergency.

Specialized training for small numbers of occupants can be given for new assignments. In the surveyed buildings, emergency team members may have received a brief verbal description of their duties when recruited to their assignments, but did not really learn their duties until instructed during a fire drill. Because their roles are often important, the gap between the date of their assignment and their first opportunity to practice these duties poses a problem. The difficulties can be resolved simply by having persons "walk through" their duties at the time of their initial assignment. Again, verbal descriptions of procedures are forgotten much more easily than a brief rehearsal of the same procedures.

D. **ANALYZE WHETHER THE SIGNAGE AND GRAPHICS ARE USED EFFECTIVELY TO CLARIFY THE PLAN.**

Many building officials will neglect to install signs explaining operating features and simple procedural instructions. In the surveyed buildings, building officials planned for or had already installed adequate signage labelling emergency features. However, with only a few exceptions, they had no plans to install simple instructions that explained the operation and procedures for using communications equipment, horizontal folding fire doors, etc. Procedures, briefly written in plain English, would be valuable reminders, and could prove invaluable should staging area occupants be entirely unfamiliar with procedures. Similarly, signs could clearly indicate the safety features of the staging areas. The addition of such

explanations seems likely to contribute to the confidence of persons occupying staging areas. Still, signs are, in themselves, insufficient to instill the knowledge and confidence needed to reliably occupy staging areas. Personal contact with knowledgeable persons, either in the staging areas or a control center, is required.

Obtrusive signage labelling staging areas is probably not required. In general, the labelling signage installed in the **six** buildings was judged to be necessary and sufficient. Signage indicating the location of staging areas does not need to be obtrusive where permanent occupants have some knowledge about the general locations. In the absence of rudimentary training, it seems unlikely that building occupants would use the staging areas anyway. Moreover, obtrusive signage seems unnecessary for visitors, because it is very unlikely that visitors would use the areas based solely on signage.

Floor plans, when posted, should be properly oriented. If floor plans appear to be upside down or sideways, they will be difficult to understand and use.

E. DEVELOP AND INSTALL PROCEDURES TO EVALUATE LIFE SAFETY SYSTEMS.

1. Develop procedures for keeping assignments current.

Emergency coordinators periodically should request that assignments of monitors be updated. The requesting official should have sufficient rank that his request will be fulfilled. Tenant organizations cannot be relied on to keep emergency team assignments current without prompting from the emergency coordinator. All surveyed building plans called for emergency teams comprised of floor monitors and various other monitors. A particularly effective technique for updating assignments was used in one surveyed building. The list of assignments was maintained on computer, and was periodically distributed to floor monitors who were asked to simply edit the list to reflect current assignments. Thus, tenant organizations received periodic reminders to update assignments, while minimizing the amount of work needed to do so.

The degree that current assignments were maintained varied greatly, and seemed to depend in part on the degree that the emergency coordinator could elicit cooperation, especially from other organizations. In one surveyed building, a high ranking official insisted on cooperation, and assignments were up-to-date. In another building, a lower ranking official filled the emergency coordinator role, and had considerable difficulty eliciting sufficient cooperation from other tenant organizations. Accordingly, many key roles were unfilled, as revealed by both interviews with building occupants and our observations during the fire drill.

2. Develop procedures for maintaining and testing key hardware systems.

Emergency coordinators need to verify that key hardware systems are being tested and maintained in accordance with a schedule. At the time of our visits, most of the buildings had not established a program for maintaining and testing the hardware features for the staging areas. While the installations had mostly just been

completed, problems were already evident. During our visit, we observed significant hardware problems of which neither the building facilities staff nor emergency personnel were aware. For example, in one building, staging area doors failed to seal properly, possibly compromising the integrity of the staging room. Where safety features are not routinely used, problems will pass unnoticed unless there is a schedule that establishes periodic tests and maintenance of such key hardware systems. Such faults can seriously compromise the viability of the selected life safety strategies.

3. **Establish goals and targets for training.**

   Explicit expectations will help emergency coordinators motivate building occupants. None of the emergency coordinators used explicit performance criteria to measure and motivate performance. However, implicit qualitative goals were employed in buildings that had effective emergency teams. For example, in one building, such implicit goals were posed as questions during the debriefing meeting held after the fire drill. The emergency coordinator would ask questions like, "Did occupants move away from the building as requested?" However stated, goals help motivate performance because behavioral expectations are clear and people gain satisfaction from meeting those expectations. Clear goals also assist in identifying problems, and finding solutions to those problems.

4. **Develop procedures for soliciting feedback from emergency team members and building occupants after training.**

   Meetings conducted just after fire drills will help emergency coordinators learn about problems and performance shortfalls. *As* with goal setting, procedures for obtaining feedback varied according to the effectiveness of the emergency organization. Only one building conducted a debriefing after the fire drill. Feedback was explicitly solicited during the meeting by asking every participant to discuss any problems that they observed. The process would be further enhanced if emergency coordinators used a list of specific performance criteria to identify problems or performance shortfalls.

III. THE WRITTEN PLAN DISTRIBUTED TO BUILDING OCCUPANTS

Many emergency coordinators will neglect to develop and distribute a separate emergency plan specifically designed for building occupants. **A** written plan for distribution should be brief and to the point. It needs only to contain a short policy statement and whatever information **is** needed to understand the basic life safety strategy and the actions occupants need to take to accomplish that strategy. In the surveyed buildings, officials rightfully judged that there would be little reason to distribute the detailed plan to building occupants. However, none of the surveyed buildings had written short and concise plans for distribution to the building occupants at large. In some instances, agencies used memorandums to disseminate pertinent information. But for the most part, buildings relied on fire drills to provide information about procedures. When building officials use the simple strategy of evacuating through designated exits, this approach may be sufficient. But with the

installation of staging areas and the associated increase in the complexity of emergency plans, the distribution of simple written materials becomes advisable.

A.   **WRITE THE PLAN SO THAT EMERGENCY INFORMATION CAN BE IMMEDIATELY LOCATED.**

Emergency plans are often written as compliance documents, intended to convince someone in authority that due attention has been paid to planning. While such documents are useful to demonstrate regulatory compliance, building occupants are unlikely to study the document even if they receive copies. They should receive a brief and simple plan that is clearly labelled and organized. **A** good test for such material is whether a person who has never read the document can find, read, and comprehend vital pieces of information in less than one minute.

B.   **WRITE THE PLAN IN EASILY UNDERSTOOD PLAIN ENGLISH.**

Clear writing is essential for two important reasons. First, persons do not have the time and motivation needed to "study" the plan. Second, some persons may lack proficiency in the English language.

Some emergency managers will need a few simple guidelines to write well organized plans in plain English. We noted two problems in the written plans we surveyed. First, there was a tendency to use bureaucratic jargon. For example, "The Emergency Planning Officer, upon direction of the proper authority, will proceed with the following plan." Second, authors often used passive instead of active sentence structures. **As** an example, "Stairway monitors are posted at assigned locations on stairways." **An** active sentence structure as follows is easier to understand, "Post stairway monitors at assigned location." Little thought was paid to the organization of the document. Tabs, color coded pages, and other devices to help quickly locate information were rarely employed.

Written descriptions of travel paths are almost unusable. Directions from floor monitors and graphic markings to show travel paths will be more effective than posted floor plans. Some plans used verbal description of evacuation routes instead of graphic floor plans. Such verbal descriptions are difficult to understand without an intimate knowledge of the building (which obviates the need for descriptions), and will not be used during an emergency. Floor plans are far easier to understand. Better still is marking routes along the visual path of travel coupled with the use of floor monitors to direct building occupants.

C.   **WRITE A STATEMENT OF POLICY.**

Policy statements should be included in distributed plans. Policy statements are desirable because they explain building management's commitment to safety, and because they may specify the responsibilities of the building occupants and tenants towards ensuring that the plan is followed and maintained. The statement should explain the legal obligations of building management, government agencies and employees, and other building tenants and occupants.

Policy statements as such were generally missing from compliance documents. Some of the compliance documents included material stating regulatory mandates, which is an important element of policy. Nonetheless, the responsibilities of building management, tenant agencies, and building occupants in general can be explained in a brief and concise paragraph. This statement can then serve as the basis for disagreements about the relative responsibilities of building management, tenant agencies, and building occupants at large.

February 18, 1992

1 TITLE AND SUBTITLE

Human Behavior Aspects of Staging Areas for Fire Safety in GSA Buildings

i. AUTHOR(S)

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11. ABSTRACT (A 200-WORD OR LESS FACTUAL SUMMARY OF MOST SIGNIFICANT INFORMATION. IF DOCUMENT INCLUDES A SIGNIFICANT BIBLIOGRAPHY OR LITERATURE SURVEY, MENTION IT HERE.)

One approach for assuring the safety of disabled occupants of office buildings, in a fire emergency, is to provide a staging area or an area of refuge where the disabled occupants can wait safely until either they can be assisted out of the building or the fire is extinguished. **GSA** has retrofitted six office buildings with staging areas to upgrade the fire safety for disabled occupants. This is a report of a project to study the six installations to determine the feasibility of staging areas from a human behavior perspective and to make recommendations for upgrading current and future installations. The study showed that government employees will accept and use staging areas. The study revealed: the need to pay attention to details in designing the communications system; the need for training the emergency team and informing the occupants; and the need for special procedures for maintenance.

12. KEY WORDS (6 TO 12 ENTRIES; ALPHABETICAL ORDER; CAPITALIZE ONLY PROPER NAMES; AND SEPARATE KEY WORDS BV SEMICOLONS)

fire protection; handicapped; high rise buildings; human behavior; office buildings; staging areas